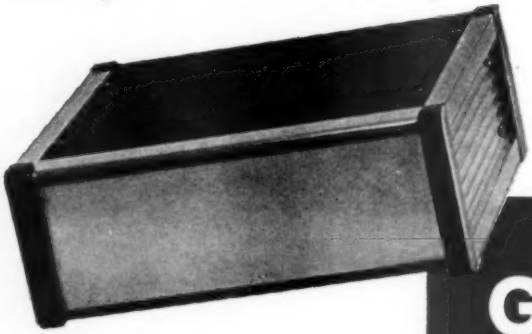
73

OCTOBER 1967
60¢

INCENTIVE LICENSING

See Page 2

Long Needed By Homebrewers!



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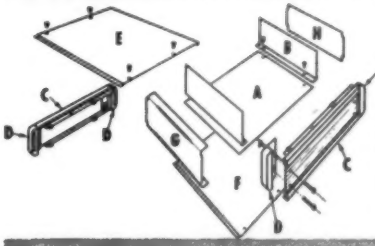

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73 Magazine

October 1967

Vol. XLVI No. 10

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Published by
Wayne Green, W2NSD/1

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"We must view with profound respect the infinite capacity of the human mind to resist the introduction of useful knowledge." Lounsbury.

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Incentive Licensing

We have been waiting with baited breath for over two years for the outcome of the incentive licensing proposal contained in Docket 15928, and now that it is here, it isn't such a hard pill to swallow after all. Although the new law, which goes into effect November 22, 1967, includes exclusive frequency bands for the Amateur Extra and Advanced licensees, the provision for special call signs for each class of license was dropped.

If you will remember, Docket 15928 proposed a new class of license, the Amateur First Class, intermediate in difficulty between the General and Extra Class. This class was to require an advanced technical test and a code test at 16 words per minute. Under the new regulations, the First Class License was dropped in favor of a new Advanced Class license. This new class of license entails a more advanced technical test than the General Class, but the code speed will remain at 13 words per minute. In other words, if you already hold a General ticket, you won't have to take the code test again—all you need is a passing score on the advanced technical test.

Also, there is no waiting period for the new Advanced Class license. You don't even have to hold another license; a new ham may go directly into the Advanced Class if he can pass the test. In addition, amateurs who hold the old Advanced Class license will be accorded all the privileges of the new Advanced Class without any further tests.

The exclusive frequency bands for the Amateur Extra and Advanced Class licensees are outlined in the table below. In addition to the exclusive frequencies on our 80, 40, 20 and 15 meter bands, the Extra and Advanced Class are provided with exclusive frequencies on six meters—100 kHz in 1968 and 250 kHz in 1969. Since none of the exclusive band segments go into effect until November 22, 1968, everyone has adequate time to qualify for a higher license class.

The only other main point in the new law concerns the Novice license. In the future the Novice license will be issued for a period of two years, non-renewable, and, on November 22, 1968, Novice radiotelephone privileges on 145-147 MHz will be deleted.

The FCC, in concluding its action on incentive licensing, said, "In reaching its conclusions, the Commission has made every reasonable effort to provide an opportunity for the remodeling and revitalization of the Amateur Radio Service without changing its basic character and spirit and without depriving any amateur licensee of the major portion of his present operating privileges. It remains only for a licensee to prove himself and to improve the Amateur Radio Service by voluntarily upgrading his license to the highest level of achievement of which he is capable. We are confident that we can rely on amateurs in this regard and that, therefore, this incentive licensing program will result in a radio service which will be a source of pride to both amateur licensees and the Commission." I concur.

. . . Jim Fisk W1DTY

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Current	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.5 - 4.0 7.0 - 7.3 14.0 - 14.35 21.0 - 21.45 28.0 - 29.7 50.0 - 54.0	3.5 - 4.0 7.0 - 7.3 14.0 - 14.35 21.0 - 21.45 28.0 - 29.7 50.0 - 54.0
November 22, 1968	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.825 - 4.0 7.2 - 7.3 14r2 - 14.35 21.275 - 21.45 28.5 - 29.7 50.1 - 54.0	3.85 - 4.0 7.225 - 7.3 14.235 - 14.350 21.3 - 21.45 28.5 - 29.7 50.1 - 54.0	3.5 - 4.0 7.0 - 7.3 14.0 - 14.35 21.0 - 21.45 28.0 - 29.7 50.0 - 54.0	3.535 - 4.0 7.025 - 7.3 14.025 - 14.35 21.025 - 21.45 28.0 - 29.7 50.0 - 54.0 (A) 50.1 - 54.0 (G)
November 22, 1969	3.8 - 4.0 7.2 - 7.3 14.2 - 14.35 21.25 - 21.45 28.5 - 29.7 50.1 - 54.0	3.825 - 4.0 7.2 - 7.3 14.2 - 14.35 21.275 - 21.45 28.5 - 29.7 50.1 - 54.0	3.9 - 4.0 7.25 - 7.3 14.275 - 14.35 21.35 - 21.45 28.5 - 29.7 50.25 - 54.0	3.5 - 4.0 7.0 - 7.3 14.0 - 14.35 21.0 - 21.45 28.0 - 29.7 50.0 - 54.0	3.55 - 4.0 7.05 - 7.3 14.05 - 14.35 21.05 - 21.45 28.0 - 29.7 50.0 - 54.0 (A) 50.25 - 54.0 (G)

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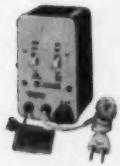

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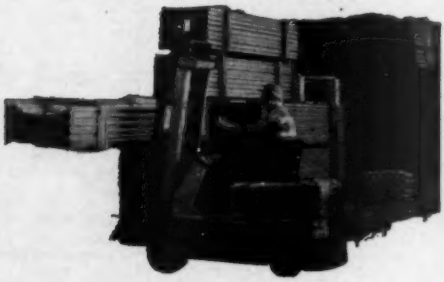

W2NSD/1

never say die

Katmandu, Nepal

After a week in the oppressive heat of Delhi, I was most enthusiastic to be on my way to Nepal. This would undoubtedly be the most remote part of the world that I would visit on my trip. I carefully reconfirmed my airline reservations on Royal Nepalese Airlines and appeared at the airport right on time to check in for the flight. "Oh, that flight just left a few minutes ago."

It seems that the schedule had been changed and no one had mentioned this to me. As I took a taxi back to my hotel I wondered what Father Moran 9N1MM would think when the plane arrived without me. Fortunately there was a flight tomorrow, so my trip schedule wouldn't be too much off. I would just have to stay in Nepal for one day instead of two, as planned.

It was just as well that I had an extra day to rest. Delhi-belly had set in with a vengeance, and I found myself dizzy and very tired, to boot. Even worse, I'd lost my Lomotil pills in the taxi yesterday. A traveler in Asia without his diarrhea pills is in bad shape.

The next morning I felt a little better and caught my plane with no problems this time. Father Moran was right there waiting for me as I got off the plane. He, and a friend, Bob, from the American Embassy, drove me into Katmandu and explained about the country. Father Moran moved up here to Nepal in 1951 after some twenty years in India. He is a Jesuit missionary and runs the foremost school in Nepal. When he arrived there was no airport in the country and no roads into it, at all. There were a few roads in Katmandu, and those very few cars that were here, had been brought in over the mountains on platforms on the backs of men.

The road into Nepal is out right now. The rains caused a section to collapse and they are busy digging a new road out of a mountainside. The road is about 85 miles long, has over 1500 sharp turns, and covers a distance of about 25 miles as the plane flies. With the road out, there are food and gas shortages in Katmandu and no relief is in sight for several more weeks.

India has kept Nepal undeveloped for many years, probably as a buffer between

(*Turn to page 92*)

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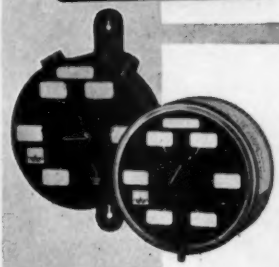

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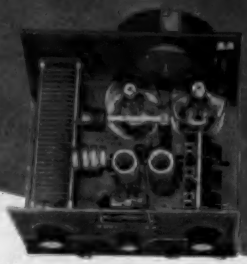

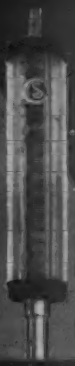

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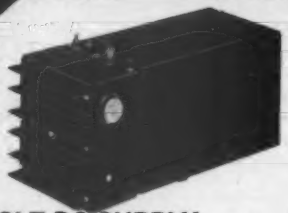

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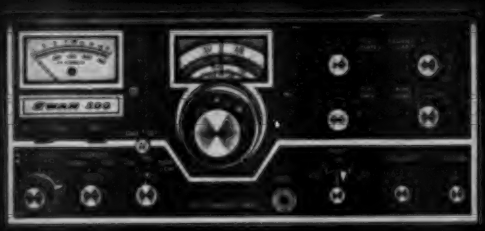

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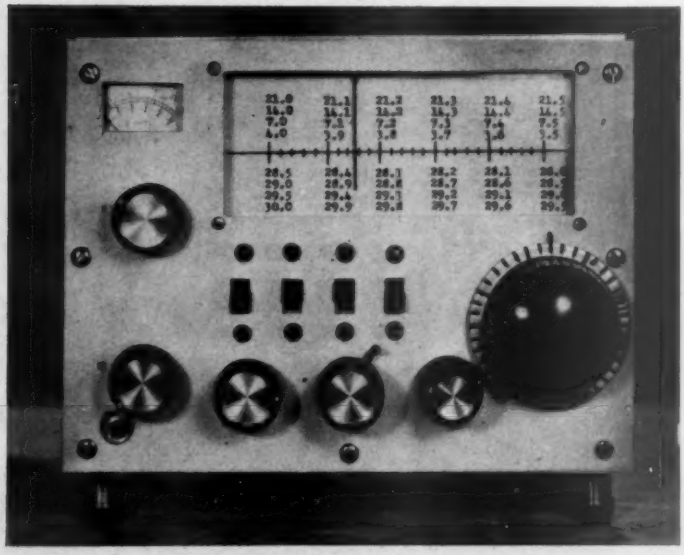
The 2Q Communications Receiver

A 22-transistor design using FET's.

A strong desire to duplicate the popular Drake 2-B receiver in transistor form, prompted the building of the receiver shown. It is the result of over two years of experimental design, building, rebuilding, testing and listening. The block diagram in Fig. 1 closely resembles that of the Drake, and for that reason I have named it the 2Q.

The completed receiver is a triple conversion superheterodyne, covering all amateur bands 10 through 80 meters. It has excellent sensitivity, selectivity and stability. Cross modulation has been reduced to a minimum by the use of FET transistors in both the rf and first mixer stages. Such features as band-pass tuning, FET detector, S-meter, age and a 100 kHz crystal calibrator are included.

The circuit shown in Fig. 2 is actually the result of two that were built. The first design, following the usual transistor circuit theory, matching impedances, etc., resulted in a receiver that lacked the necessary sensitivity and selectivity. Cross modulation was also a problem because bipolar transistors were used in the front end. The second design is the result of a concentrated effort toward obtaining maximum selectivity by the use of small capacity coupling where possible, high Q tuned circuits, and tapping collectors down on the coils to preserve their Q. Cross modulation was reduced to a minimum by using FET transistors in both the rf and first mixer stages and by using a separate rf gain control.



Front view of the 2Q transistorized receiver. Bottom, left to right, are the phone jack, band-switch, rf gain, band-pass tuner, selectivity switch combined with rf and volume control, and main tuning. Switches, left to right, are age S-meter switch, dial light, 100 kHz calibrator and bfo.

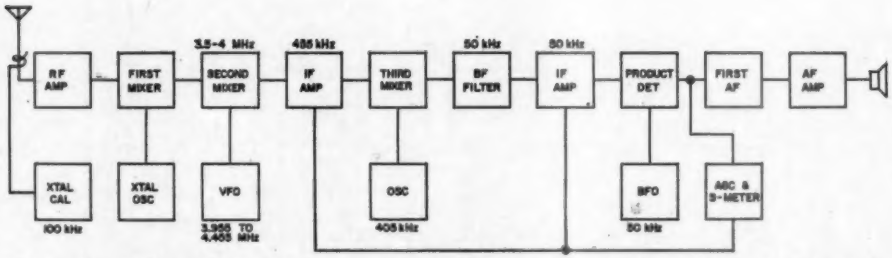


Fig. 1. Block diagram of the 2Q, a completely transistorized communications receiver of modern design using FET's in the front end.

The circuit

Much has been written on transistor circuitry during the past few years so I will be as brief as possible and describe only those points which I think important or unusual.

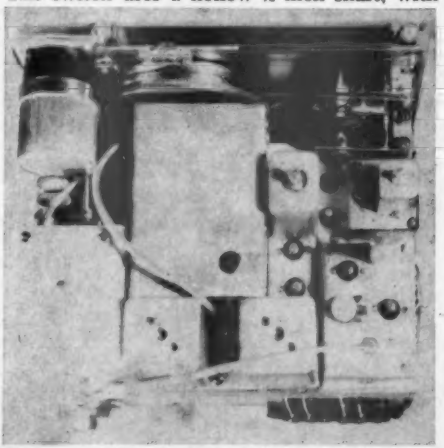
Capacitive coupling is used throughout the front end (preselector). It uses high-Q toroid coils and slug-tuned coils. The simple switching provides the necessary selectivity and ease of adjustment desirable when compact construction is used. Ami-Tron toroids were not used for the 15- and 10-meter bands due to the lack of space for the necessary trimmer capacitors, but their use is definitely recommended for all bands. The selectivity and stuffing ratio gained by their use is very necessary. The tuning capacitor, a two-gang trf unit, was reduced to 200 pF per section. Space for the rf choke was solved by placing it in the crystal oscillator compartment.

The FET mixer, using source injection, is capacitively coupled to the second mixer. The circuit, possibly of my own design, was preferred to a gate injection circuit. The only FET's available were N-channel 2N3823's, but possibly some of the cheaper ones will work as well.* I intend to try the Motorola MPF 105 FET when I can locate a distributor who stocks them. Alignment of the front end is simply a matter of adjusting turns, spacing, and trimmer capacitors, until the amateur bands are staggered across the preselector dial.

The 3.5 MHz-4.0 MHz variable *if*, mixer and oscillator section, consists of a high-C Colpitts oscillator, and a base injected mixer, with an output at 455 kHz. Only the highest quality components should be used here, since it is a major frequency determining circuit.

Only one stage of amplification was found necessary for the 455 kHz *if* section. The mixer is capacitively coupled with base injection at 405 kHz from a high-C Colpitts oscillator giving a 50 kHz output. Here again the oscillator is a major frequency determining circuit and care should be used in its construction. The 455 kHz *if* coils can be any high-Q center tapped units, preferably using toroids or cup cores. This is a good spot for a mechanical filter; something I intend to try in the near future.

The band-pass tuner was constructed using coils wound on 1" diameter powdered iron toroids from an old telephone company audio filter. The ones I used were blue and numbered A9301572. The tuning is done with a three-gand trf type broadcast tuning capacitor, with a stop added to limit its travel to about 20 degrees, starting from maximum. The switch uses a hollow ¼ inch shaft, with



Top view of the 2Q receiver, showing the layout of the various parts.

* 2N3819 FET's seem to work as well as the more expensive 2N3823's. With the 2N3819, the only circuit changes were in the rf amplifier—the source was grounded and B+ changed to 14 V. Motorola MPF-103's have been tried too. At 90¢ each they seem to work as well and their specs are almost identical.

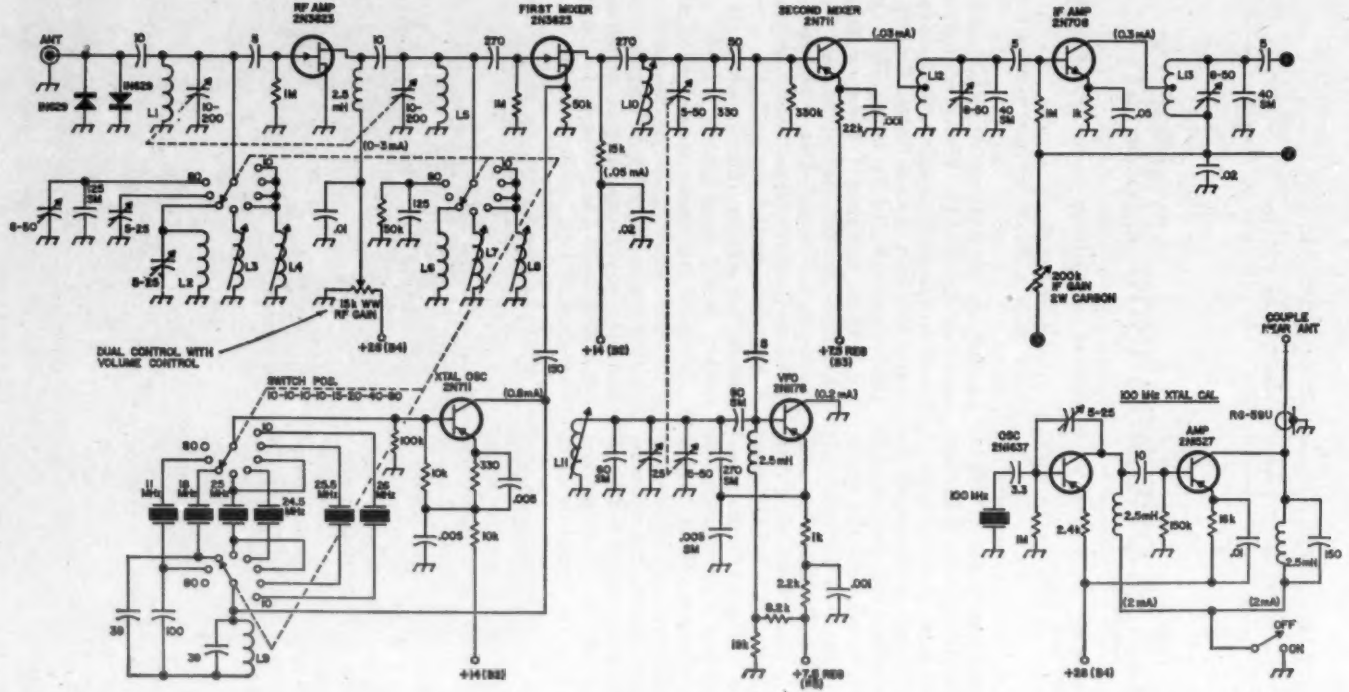
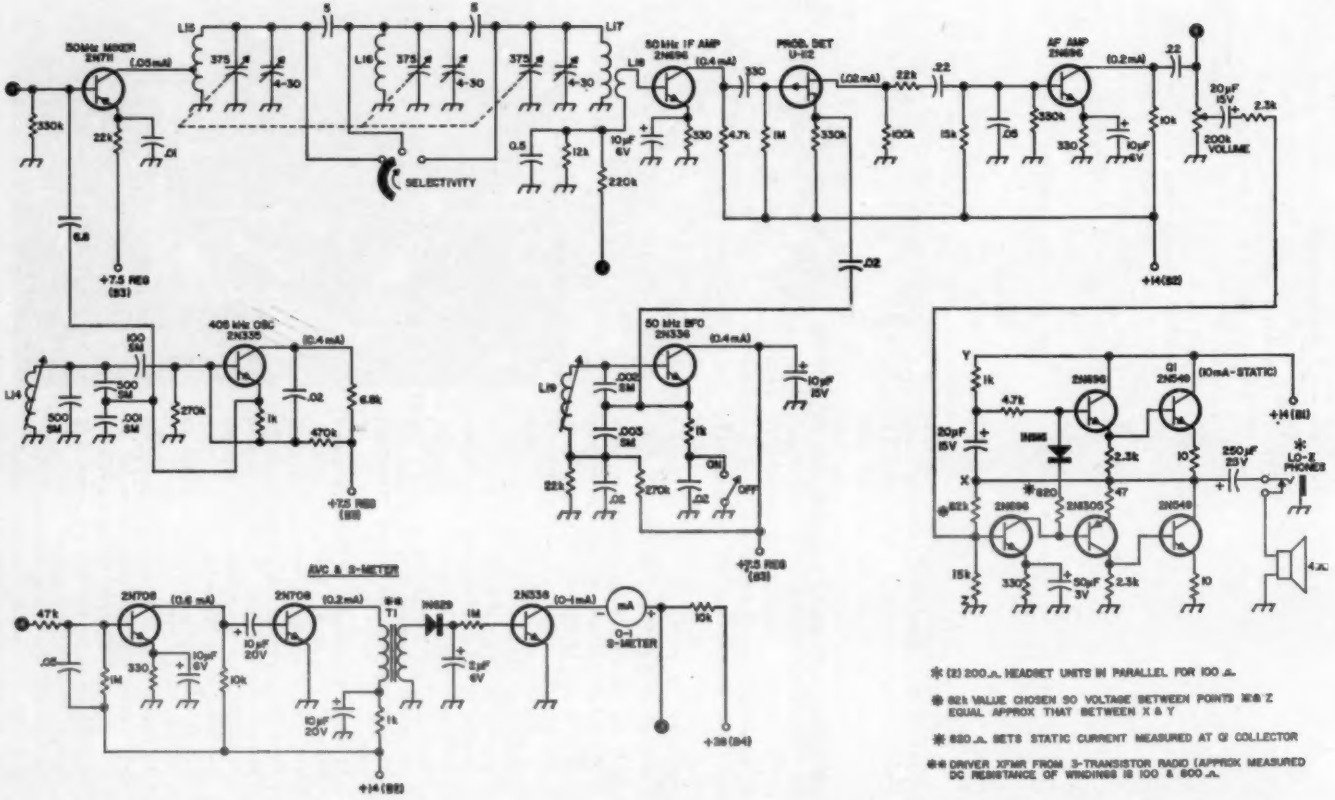


Fig. 2. Schematic diagram of the 2Q communications receiver. The currents shown in parenthesis are the collector currents for each stage. The rf chokes used were 3-pi types on ⅛-inch iron cores taken from a surplus computer board although miniature 2.5 mH units should work ok. Coil values are given in Table 1. Later experimentation by W5ETT indicates that the bias network used with the 2N708 455 kHz *if* amplifier was not too tolerant to different transistors. He recommends removing the 1M base-bias resistor and replacing it with a 330k resistor *and* a 27k resistor from base to ground.

*T-68-2 and T-50-6 toroid cores may be purchased from Ami-tron Associates, 12033 Otsego Street, North Hollywood, California. Price 50¢ each plus postage.



✻ (2) 200 Ω HEADSET UNITS IN PARALLEL FOR 100 Ω.

✻ 82k VALUE CHOSEN SO VOLTAGE BETWEEN POINTS X & Z EQUAL APPROX THAT BETWEEN X & Y

✻ 820 Ω SETS STATIC CURRENT MEASURED AT Q1 COLLECTOR

✻✻ DRIVER X'FMR FROM 3-TRANSISTOR RADIO (APPROX MEASURED DC RESISTANCE OF WINDINGS IS 100 & 600 Ω.

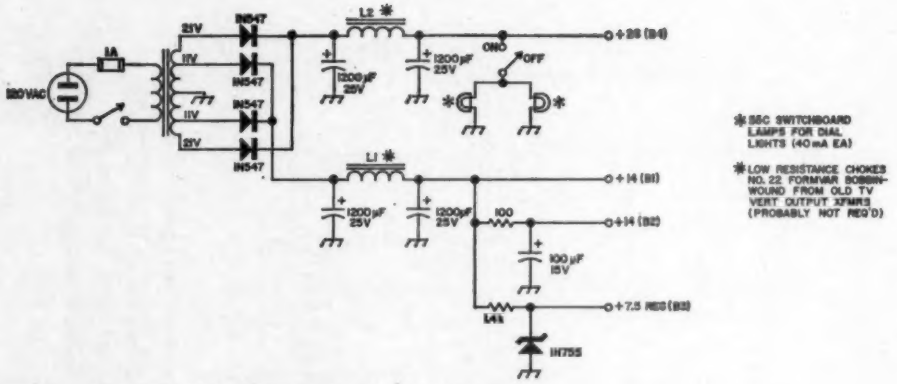


Fig. 3. AC power supply for the 2Q communications receiver.

the TC shaft being operated through it.

The FET detector using a P-channel U112 or 2N2497 has plenty of bfo injection and works very well on SSB.

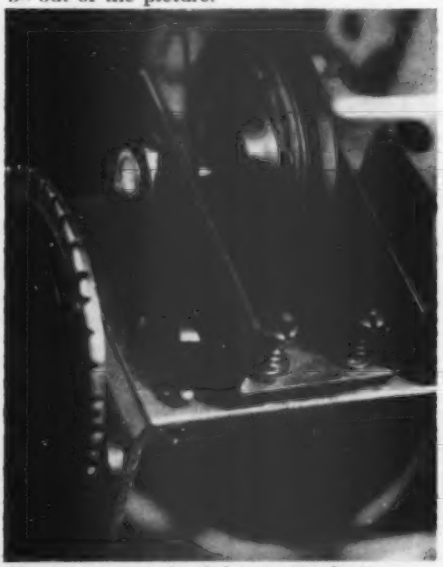
Good S-meter action and a certain amount of gain control is provided by the circuit shown by simply reducing the amount of voltage applied to the *if* transistors.

I had some trouble getting the 100 kHz crystal calibrator aligned with WWV, so it was necessary to devise the circuit shown. WWV may be received on the receiver, during daylight hours here, by putting it on 7 MHz and tuning the preselector to minimum capacity.

From this point, the rest of the receiver is simply audio, six transistors in all, with a transformerless audio circuit taken mostly from a GE transistor manual. The power supply, one left over from another project, is no doubt overfiltered. Any well-filtered dc source of 14 V and 28 V will do. The receiver draws 20-125 mA depending on volume. The dial lamps use an additional 40 mA each. The receiver will work well on only 12-14 V, but the S-meter and AGC will be out of the picture.

Table 1. Coils for the 2Q receiver.

L1	32 turns #22 Formvar on T-68-2 toroid core.
L2	20 turns #22 Formvar on T-50-6 toroid core.
L3, L4	20 turns #22 Formvar, 1/4" diameter with last 6 turns spaced to take a 1/2" long powdered-iron core.
L5	Same as L1 except 33 turns.
L6	Same as L2 except 23 turns.
L7	Same as L3 except 23 turns.
L8	Same as L3 except 23 turns.
L9	30 turns #24 enameled, 1/4" diameter.
L10	22 turns #24 enameled on 1/4" slug-tuned form.
L11	15 turns #24 enameled on 1/2" form, spaced diameter of wire. 3/8" powdered-iron slug.
L12, L13	110 turns, 6-strand Litz wire, tapped at 55 turns. Pi wound on 1/2" diameter ferrite cupped core 1 1/2" long. Three cups stacked to obtain necessary length after grinding out center of middle core.
L14	120 turns, 6-strand Litz wire, pi wound on 1/4" slug-tuned form.
L15, L16, L17	330 turns using 3 strands #29 enameled wire wound on powdered-iron toroid 1" diameter, #A930157-2. Toroid cores from old telephone equipment will work. L15 tapped 50 turns from ground end.
L18	10 turns #22 Formvar wound over L17.
L19	800 turns, 6-strand Litz wire, layer wound 1" long on 1/4" slug-tuned form.



Close up view of the dial tuning mechanism.

Choice of transistors

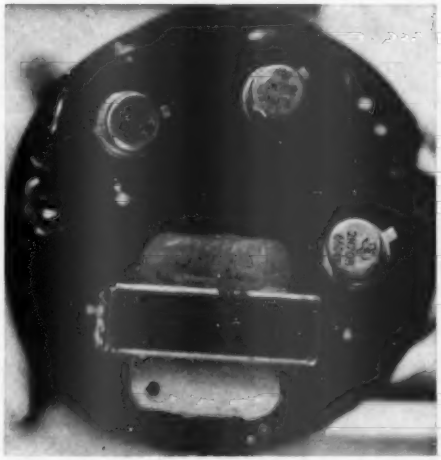
The transistors used are by no means the only ones which will work in the receiver. My choice was made largely from tests with the ones which were available in my transistor junk box. Either PNP or NPN will work in most circuits, NPN being preferred in most cases for *if* and oscillator traisistors. Oscillator types should be those that have no internal connections to the case. The use of sockets for all transistors is highly recommended.

Construction

The receiver cabinet measures 8½" long x 6¾" high x 6½" deep. The receiver is divided into a number of sub-assemblies mounted on a main chassis, made of 14-gauge aluminum. The sub-chassis are of 21-gauge aluminum.

Only the 50 kHz *if* amplifier and audio stages were built on the main chassis. The S-meter and agc circuitry were mounted on the back of the S-meter. **Fig. 4** is a rough layout of the front panel.

The slide rule dial has a tuning rate of 45:1 or 45 turns of the tuning knob to cover 500 kHz. This gives at least 25 revolutions on the 40 and 20 meter bands. The mechanism consists of a weighted knob on a ¼" shaft driving a 2" rubber tired wheel (Jenson #J1490-01) on a ¼" shaft driving a dial cord to a 3½" dial drum on the tuning capacitor. The dial scale was made on white paper (pasted to a piece of stiff cardboard) using a black ball point pen and a typewriter. The dial drum was made from a reinforced, nickle-plated lid from a peanut butter jar.



Back view of the S-meter. One of the 2N708's (Q15) was replaced with a 2N338 after this photo was taken for better agc and S-meter action.

Conclusion

No wild claims shall be made for this receiver except to say it is the best homebrew receiver I have ever owned. Only 5 feet of wire strung up in the shack has been found necessary for good reception. Many hours were spent just listening and hearing signals that I could never hear with my old 14-tube homebrew receiver. I would like to thank Jim Miles W5KWJ for his comments and encouraging me to write this article.

. . . W5ETT

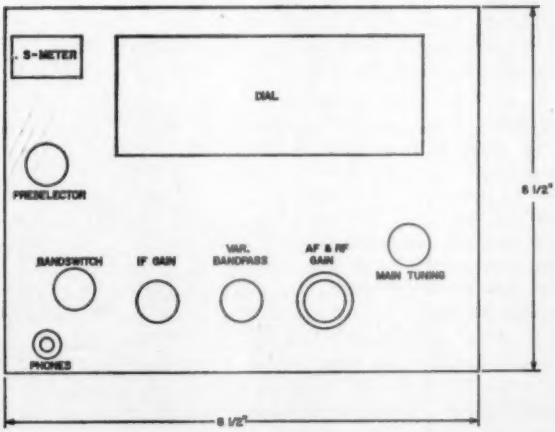


Fig. 4 Front panel layout used by W5ETT in the original model of the 2Q receiver.

George Cousins VE1TG
RR 2
Lower Sackville, Nova Scotia
Canada

A Really Rugged Rotator

Whether he is an old-timer or raw beginner, there are probably very few hams who are not somewhat familiar with the old reliable prop-pitch motor. Just after World War 2, the surplus market saw a veritable flood of them, and, along with coaxial cable, they caused quite a revolution in the construction and operation of rotary antennas. Many of the motors which were put into use right after the war have performed faithfully over the years, and even today there is really nothing which can approach them for sheer power and ease of operation.

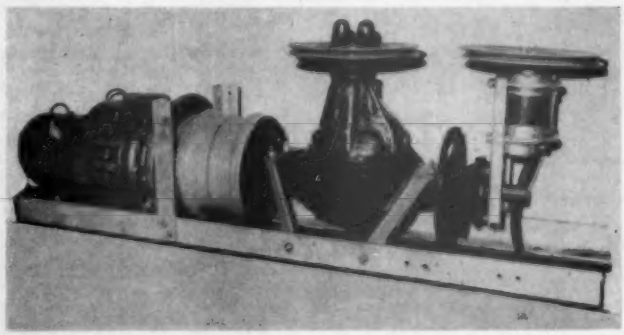
Before the prop-pitch motor may be used as a rotator, the brake assembly and limiting dogs are usually removed and some sort of coupling or bracket is welded to the output gear. The motor is then mounted vertically inside the tower and supplied with 24 volts ac or dc. Refinements such as remote controls and direction indicators are left up to the imagination of the owner.

One of the very few faults with his arrangement is the tendency for moisture to collect inside the motor housing, especially on the brushes, with the result that the motor turns very erratically or not at all. It goes without saying that this usually happens in the winter, just when the rig is being used the most and when the working conditions at the top of the tower are at their worst. I have known hams who have gone to amazing lengths to prevent this, but in most cases the solutions have not been too successful.

Another point, particularly in cold climates —the oil in the gear box congeals putting quite a load on the motor. This causes very slow starts and extremely slow rotation of the antenna. Since the usual rotation speed of the output gear is only about three-quarters of an rpm, any further decrease is intolerable. It is possible to open the gear box and pin one set of planetary gears, which will approximately double the output speed, but many hams apparently would rather put up with the slow speed than monkey with the gear train.

Before starting on the construction of my own rotator, I thought over all the pros and cons of the situation and eventually came up with a unit which seems to overcome all these problems. Construction is quite simple and the cost is very reasonable.

The biggest factor in this rotator was the decision to mount the motor in the horizontal plane, just as it was in the aircraft. The ideal approach at this point would be to procure the mating gear which originally was on the end of the propeller blade, but this is apparently impossible to find. It seems equally difficult to find any other suitable gear, so this idea was soon



The really rugged rotator on the bench at VE1TG before it was mounted on the tower.

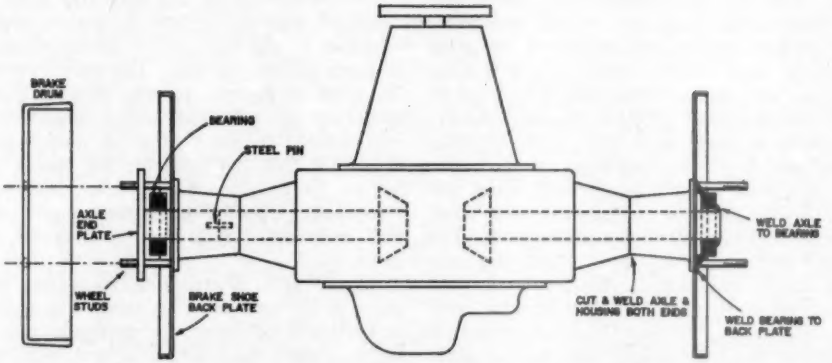


Fig. 1. Mechanical details of modifying the automobile differential before installing the prop-pitch motor.

forgotten. The problem is to find a way to obtain a right-angle drive, along with a bearing, which will support the heaviest possible antenna load. The most common item which comes to mind is the differential or automobile "rear-end". Certainly it is the most available! In addition to being a right-angle device, it is extremely sturdy, and if properly set up, it will provide a step-up speed ratio. The exact ratio will depend upon the original design of the associated car, but it will be somewhere around 2 to 1, or a little better. When the prop-pitch motor is coupled to the axle of the differential, the *drive shaft* turns at 1½ to 2 rpm, thus solving one of the major drawbacks of the prop-pitch motor without modifying it. There is no problem with the differential being able to support the antenna, and the strength of the internal gears is far in excess of any torque which the antenna will exert.

By mounting the motor horizontally, any moisture which collects inside the motor housing will run to the bottom and a small drain hole will take care of it. With the infrequent operation and very high quality of the gears, it is doubtful if any oil is actually required for lubrication. It can either be drained out completely, or a small amount left inside. With the horizontal mounting, the gears will pick up some lubrication during each revolution if a small quantity remains in the box. In any case, the problem of congealing is eliminated.

We have therefore overcome the major drawbacks of the prop-pitch motor and can proceed with the actual construction. Because of the length of a car rear-end, it would be too ungainly to mount in the average tower. In fact, it must be understood at once that this rotator is quite heavy, but since it is intended for use with large and heavy arrays it would be necessary to have a heavy-duty tower. It is ideal, of course, for the windmill type of tower, or for base mounting with a long drive shaft.

A quick inspection of the nearest junk yard will provide the rear-end you need. It is best to look for small cars, since even the smallest unit will be satisfactory. I found an old Morris rear-end which was ideal from the size and ratio standpoints. Make sure the brake drums are still on the unit, but remove them when you get home. One brake drum is positioned on the output gear of the prop-pitch and welded to it. Make sure that this is done carefully and accurately, as it is going to provide the coupling between the prop-pitch motor and rear-end after it is modified. This is also a good time to remove the brake assembly and dogs from the motor, and drain out the oil if you live in a very cold climate. Also pull out the motor power leads, and label them—clockwise, counter-clockwise and common. You may have to hook up 24 volts temporarily to find out which is which, but this should only take a few minutes. If you expect to be digging for weak signals, the motor should also be fitted with filtering capacitors from each brush holder to ground. Small micas can be used but the .002, .001 or even .01 disc ceramic is more convenient because of its small size. These steps will complete the modification of the motor itself.

The next step is to cut down the rear-

end. First of all, remove both axles and set them aside. Then cut off both axle housings within one or two inches of the gear housing. If a power hacksaw is available, the job may seem easier, but the shape of the unit makes it difficult to hold steady. An ordinary hand hack-saw is entirely adequate and is actually easier to use. In order for the unit to transfer power from one axle to the antenna drive shaft, the other axle must be prevented from turning. The easiest way to do this is to insert one axle into its normal gear in the rear-end, then cut it off flush with the gear housing, and weld it to the housing itself. However, a study of the photograph will show a little more elaborate arrangement. The axle housing is cut off near the brake shoe assembly. The axle is inserted through the bearing in the brake assembly and on into its mating gear. The brake assembly is welded to the gear housing, the axle is cut off flush with the end of the brake-assembly bearing, and then welded to the bearing. The bearing in turn is welded to the brake-assembly.

The end result is the same, but now the backing plate can be used to help form a mounting bracket arrangement for the complete rotator.

The other side of the rear end must be modified with more care to ensure proper coupling to the motor. The actual coupling is accomplished by using the wheel mounting studs on the axle to mate with the corresponding holes in the brake drum which was welded to the prop-pitch output gear. By using this arrangement, the motor can be quickly removed for servicing by merely removing the mounting brackets on the motor itself and sliding it away from the differential.

In order to construct the coupling, both ends of the axle must be used. The splined end should be inserted completely into its mating gear, and the axle cut off flush with the edge of the gear housing. Now, note that the remaining piece of axle must be cut off about three inches from the round plate on the end. This piece of axle (with the plate on it) must be welded to the piece which is inserted into the gear. The result will be a much shorter version of the original axle. It is best to have the two pieces welded together. Any reasonably good machine shop can do this. When this new axle is inserted in place, the axle housing must be carefully measured and cut off in such a way that it can be inserted through the brake-assembly bearing, the

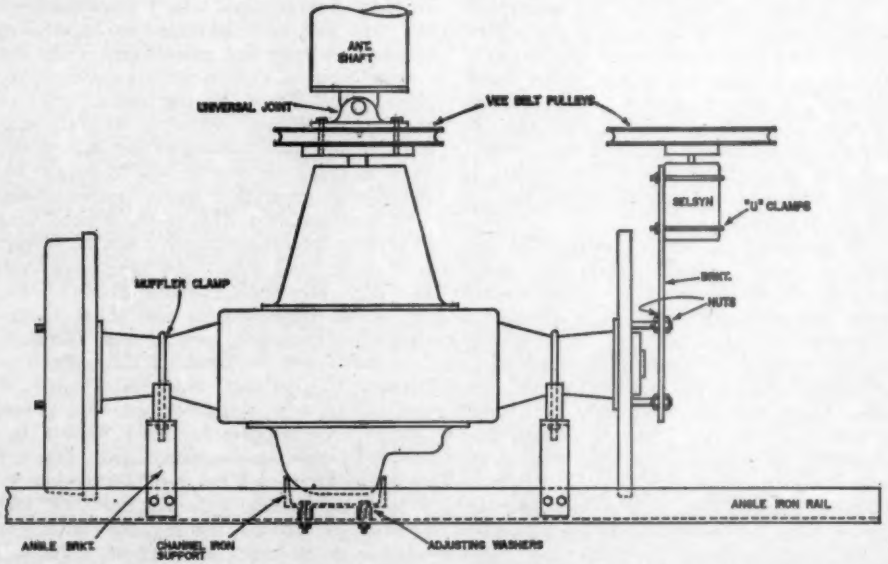


Fig. 2. Mounting details of the differential, selsyn drive, and antenna drive shaft. The mounting brackets can be made as shown here, but in the photo, brackets were made of scrap material and the muffler clamps mounted upside down. Either method is satisfactory.

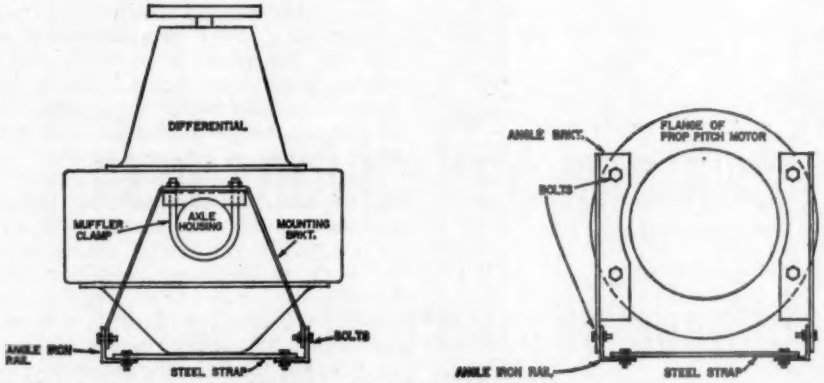


Fig. 3. Side view of the rail-mounted differential and prop-pitch motor.

plate on the axle can mate properly with the studs on the brake assembly, and the housing can be welded to the differential housing. **Fig. 1** will probably make this more clear than the verbal description. After the axle has been fitted and the housings welded to each other, the brake drum can be slipped over the studs and fastened onto the axle plate with the two or three original screws. The studs are now in place, ready for insertion into the holes on the prop-pitch drum.

The entire assembly must now be mounted, and probably the simplest way is to use two lengths of heavy angle iron or aluminum to form support rails. The prop-pitch motor is laid horizontally between the rails, with the gear case housing providing its own support. Two short pieces of angle are bolted to the side rails and to the large flange of the motor gear box. This prevents any rotary movement of the motor. Two other pieces of angle are used to hold the rails together, otherwise the weight of the motor tends to force the rails apart and put the entire weight on the bolts in the side pieces of angle. See **Fig. 3.**

The differential assembly is coupled to the prop-pitch motor and carefully adjusted so that the whole affair is level both end to end, and side to side. Mounting brackets can then be made out of mild steel strap. The brackets are first fastened to the housings by standard muffler clamps, making sure the assembly is level. Then the legs of the brackets are bolted to the side rails. Unless a large unit is used, it's not likely that the bottom of the differential will be resting on the edges of the rails. To provide additional support, a piece of channel steel should be used to support the under-side of the differential, with its height being adjusted by washers or sheet-metal shims. **Fig. 2** and **3** show this arrangement.

The top of the differential must now be coupled to the antenna drive-shaft. As the differential itself will have a heavy plate attached to the internal gearing, a mating plate or flange can be cut from stock and welded to the antenna drive-shaft. Matching holes are drilled in the flange and then the flange is bolted to the differential plate. A more flexible arrangement can be made by procuring the universal joint and possibly even the entire drive shaft of the original car. In my case, the rear-end cost me $5.00 and the drive shaft was thrown in for nothing, so cost was no factor. By using the universal joint, some mis-alignment between rotator and antenna can be tolerated, and the shaft can be quickly uncoupled if

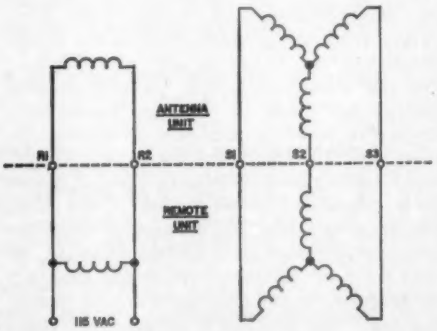


Fig. 4. Interconnection for the selsyn motors. A four-wire system may be used if terminals R2 and S3 are run on the same wire.

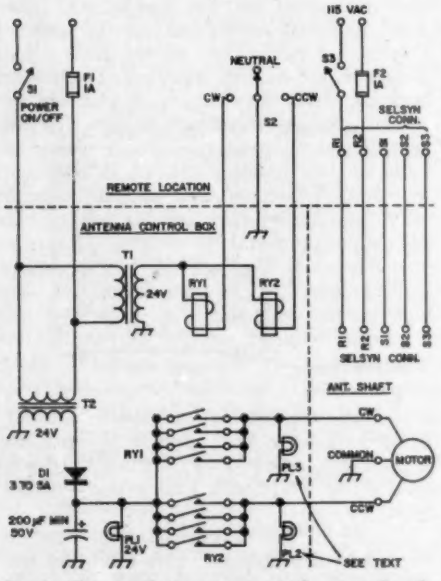


Fig. 5. The complete remote-control system for the really rugged rotator. If suitable 24-volt relays cannot be found, two 12-volt automobile horn relays may be used with a dropping resistor.

necessary. See **Fig. 2.**

The last step in the rotator itself is the direction indicator, and for this purpose there is really nothing that can do as good a job as a pair of selsyns. Many units are still available on the surplus market, though the easiest to use are those designed for 115 Vac. The hook-up for the selsyns is shown in **Fig. 4.** Mechanically, the antenna selsyn is mounted on a metal plate with two home-made U-bolts. The plate is mounted on the wheel studs of the brake assembly opposite the prop-pitch motor. The drive system from the antenna shaft to the selsyn consists of two V-belt pulleys of equal size, and the V-belt itself. The cheapest suitable pulleys are made for use on laundromats or dryers, and are available from any appliance service shop. The correct size V-belt can be obtained at the same time. The first pulley is drilled to accept the same bolts which couple the differential to the antenna shaft, and the second is mounted onto the shaft of the selsyn. It will probably be necessary to make up some sort of mounting plate and possibly a set-screw arrangement. This depends upon the type of pulley used as well as the type of synchro. See **Fig. 2** for details.

A suitable terminal board should be provided to handle the three motor-control wires and the five selsyn wires. In addition, a weather-proof cover should be made up to cover at least the selsyn and terminal board. The motor and differential are well able to stand the weather just as they are.

The control method which is used will depend upon the desires of the individual and the available materials. All that is really necessary is a means of getting 24 volts ac or dc to the motor, and switching it between the cw and ccw wires. The selsyn wires are merely connected to the remote selsyn, and the remote unit is fitted with an indicator needle and some sort of compass scale. The antenna is pointed north, the remote selsyn housing is loosened and turned until the needle points north on the scale, and the housing tightened up.

However, a more elaborate control unit is illustrated in **Fig. 5.** Since the unit is mounted on the tower, the low voltage, high current leads to the motor should be as short as possible. A pair of 4-pole double-throw relays handle the motor switching, with all poles wired in parallel to minimize the possibility of arcing or burned contacts. The 24 volt ac supply is rectified with a high-current silicon diode, filtered and the resultant dc used to feed the motor. While not necessary, the motor seems to run quieter and smoother on dc than ac. The 24-volt transformers and relays used in this unit were salvaged from pin-setting machines in a defunct bowling alley, but any similar components will be suitable. Alternatively, a pair of 12-volt units can be hooked in series, and a couple of automobile horn relays used for switching.

On this particular unit, a large 24-volt pilot lamp is mounted on the side of the control box and is visible from the ground. It monitors the output dc immediately before it is applied to the direction relays. This is being modified to two lights, which will be connected directly to the motor input leads. Should the antenna fail to turn at any time, a quick look at the tower will show whether or not voltage is getting to the motor. This will immediately point out motor trouble or control unit trouble (*or burned-out bulbs! ed.*) and is a handy trouble-shooting aid.

The resultant rotator is very rugged and will prove suitable for the largest and heaviest stacked arrays. ■

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Designing Permeability-Tuned Coils

If you have trouble designing slug-tuned coils for your construction projects, here is an approach that is simple and almost foolproof. It even shows you how to use those old slug-tuned forms that you have in the junk box.

Within the last decade, the development of improved ferrite core materials, stemming from basic research into the nature of magnetic materials, has brought about a quiet revolution in the art of coil design. Inductors wound on powdered iron require fewer turns of wire for a given inductance than conventional aircore units, which not only permits them to be more rugged and compact, but also reduces their dc resistance, thus raising Q. In addition to packing a lot more coil into less space, such an inductance may be easily varied-without taps or unreliable sliding contacts–simply by sliding the core in and out of the coil (permeability tuning).

Recently, needing a dozen of them, and not having any ready cash, I concluded that I would have to wind them myself. An inspection of Ye Olde Junque Boxe turned up a myriad assortment of ferrite slugs, phenolic forms, and magnet wire, scrupulously gleaned from the innards of defunct TV and BC sets, and hoarded against a rainy day. However, a subsequent examination of the common radio handbooks gave no indication of the proper proportions in which to combine them. Other experimenters in my predicament had apparently been content to hole up in the shack with a GDO and some wire until they haphazardly chanced upon a combination that worked. Experimenter oriented literature on the whole subject is practically nonexistent, and the dearth of theoretical knowledge, design data, and practical construction techniques, seems to have limited amateur efforts strictly to cut-and-try for which I have a violent distaste. I'm a designer, not an experimenter! When I build a project, it works right the *first* time! Well, would you believe the second time? How about the thirteenth?

At any rate, research in the handbooks on the basic properties of inductance, plus a little benchwork, resulted in what seems to be a fairly simple, predictable procedure for designing slug-tuned coils.[1] Only a little math is needed, and it's just simple algebra. The hard work is sidestepped through the use of a chart. The only materials required are a pencil and scratchpad (a slide rule helps if you can use one, but it's not absolutely necessary), some ferrite slugs, matching coil forms, and magnet wire, all of which should be included in any junkbox worthy of the name. (Well, you *can* buy it, if you really *must!*) All set? Let's get started . . .

Ferrite cores and permeability

The heart of a high-Q variable inductance coil is the ferrite core itself. It is available in a variety of shapes and sizes, ranging from the familiar gray, cylindrical slugs to rods, bars, tubes, and such esoteric forms as toroids and cup-cores (for special applications where a coil's magnetic field must be self-contained). Although commonly and collectively referred to as "ferrites," such cores are not solid iron, nor are they all

alike. Rather they are compounded of varying proportions of metals such as nickel, iron, manganese, molybdenum, zinc, or their oxides, depending upon their manufacturer and intended application. The rods, bars, tubes, toroids, and cup-cores, are usually used for fixed inductances; while the cylindrical slugs, in conjunction with a phenolic or ceramic coil form, are used for variable inductors, adjustable by a brass screw around which the core is cast, or by use of threads molded into the core itself.

The characteristic which makes ferrite cores suitable for compact variable inductances (and the basis of the design procedure) is their permeability, denoted by the Greek letter μ (mu). Given a coil of fixed dimensions, with a removable ferrite core, permeability may be defined as the ratio of the coil's inductance with the core completely inserted, to its inductance with the core completely removed (that is, when the core material is air). This relationship may be expressed mathematically as

$$\mu = L_{core}/L_{air} \qquad (1)$$

If, for example, a coil has a normal air-core inductance of 2.5 μH, but increases to 10 μH when a ferrite core is inserted into it, the permeability of the core is 10μH/2.5 μH = 4.0. The significance of the formula is that it also works in reverse. If a coil designed to have a normal inductance of 2.5 μH is wound on a core with a permeability of 4.0, its inductance is thereby increased to 4.0 x 2.5 μH = 10 μH. In other words, it is possible to increase an inductance by a factor of μ without increasing its physical size merely by winding it on a high permeability core.[2] This is readily apparent if equation 1 is transformed to yield

$$L_{core} = \mu\ L_{air} \qquad (2)$$

Designing fixed inductors

Equation 2, plus the standard coil-winding formula[3], $L = \sqrt{(rN)^2/9r + 10l}^{\ 4}$, are the only ones needed to design fixed-value ferrite-core inductances. To show how, let's try an example:

Suppose we want a 45 μH inductance, and we want to wind it on a core with $\mu = 3.0$. Dividing 45 by 3.0, we find that what we really need is a coil with an air-core inductance of only 15 μH, so that when we wind it on the core, the core's permeability will multiply it to full value. Knowing this, we then turn to the coil winding formula to find its physical dimensions. Before we do however, there is another factor to take into consideration: in order to get the maximum effect from the insertion of a ferrite core into a coil, the length of the core should equal the length of the coil, and the coil diameter should be such that the core just fits snugly within it. Thus, if the core in this case is 1" long by ¼" in diameter (0.125" radius), these should be the dimensions substituted into the coil-winding formula. Making the substitution, and solving for the proper number of turns, we find

$$N = \frac{\sqrt{L(9r + 10l)}}{r}$$

$$= \frac{\sqrt{15(9 \times 0.125 + 10 \times 1)}}{0.125}$$

$$= 52 \text{ turns}$$

To simplify matters, let's also assume that the coil will be closewound; thus, given the length of the coil (1") and the required number of turns (52), and dividing one by the other, we find that we need to pick a wire gauge yielding 52 turns per linear inch. A wire table shows that #25 enameled, at 51.7, will do quite nicely. The final result, then, is that we may obtain a 45 μH coil using the given slug (1" x ¼", $\mu = 3.0$) by closewinding 52 turns of #25 enameled wire on the slug.[5]

In a similar manner, specifications for any coil, using any cylindrical core, may easily be determined.

Determining permeability

So far, so good—if you know the permeability of the core material you want to use. But, suppose you don't? Unfortunately manufacturers rarely imprint slugs with a designation of μ, so what happens if you fish a typical, unlabeled, gray slug out of Ye Olde Junque Boxe?

There are two methods to determine permeability, one using an inductance bridge, and the other, a bit more involved, using an rf signal generator (a GDO, LM or BC-221 Frequency Meter, or any other calibrated, variable rf source will do as well) and a few other items we'll come to in a moment.

Using the bridge method, one first winds a test coil. Its inductance is not critical, but its dimensions are. As noted previously, it should be just as long as the core under

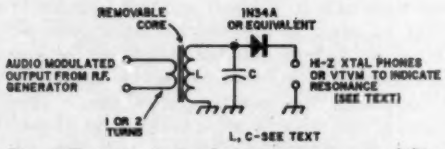

Fig. 1 Test circuit to determine core permability. Measure resonant frequencies with core inserted and withdrawn.

test, and just wide enough that the core fits snugly within. Measure the value of the coil's inductance, first with the core in the coil, and then with the core removed. Substitute the values of these measurements into equation 1, and divide to find μ.

Using and understanding the rf generator method entails a little math, and the construction of a test circuit. First the math: from the standard formula for the frequency of a resonant circuit, we know that

$$f = 1/2\pi\sqrt{LC} \quad (3)$$

So, given a tuned circuit in which the capacitance remains constant, and using an inductor with a removable ferrite core, one can divide out the 2π and $\sqrt{C}$ terms and simplify to show that

$$(f_{air}/f_{core})^2 = \mu \quad (4)$$

This tells us that, by measuring the resonant frequencies of a tuned circuit with the core under test both in and out of the tank coil, and squaring the ratio of the latter value to the former, permeability can be found.

In practice, such measurements can easily be made with the crystal detector test circuit of **Fig. 1.** As illustrated, a modulated rf signal is fed from a generator to a resonant circuit LC, via a one or two turn coupling link. Since we are only concerned with the ratio of two frequencies rather than the frequencies themselves, the values of L and C are not particularly critical as long as they are resonant somewhere within the frequency range of the generator, and the previous comments about L's dimensions are noted. With everything connected, measure the resonant frequencies of the circuit with the core both in and out of the coil, using the diode detector and earphone to indicate the point of maximum signal. The earphone should be a high-Z crystal unit, so as not to load the tank. (A VTVM could be used in its place, but the earphone is almost as accurate, far more sensitive, and much cheaper). Substitute the measured frequency values into equation 4 to find μ.

Designing variable inductors

Since the principal application of cylindrical ferrite cores is to slug-tuned coils, let's see how to design one. As with fixed inductors, the problem is one of starting with a known "target" value of inductance, a slug of known size and permeability, and being able to find an equivalent value of air-cored inductance which may be wound using the standard coil-winding formula. However, in this case, a new factor enters the picture.

It should be apparent from the previous sections that when a slug having a permeability of μ is inserted into a coil with an air-core inductance, L_{air}, the total inductance of the combination then becomes $\mu L_{air} = L_{core}$. L_{core} and L_{air} are the coil's two extreme values, obtained with the core completely within or completely outside it. Obviously, then, if the core were inserted into the coil only partially, its inductance would be somewhere between L_{air} and L_{core}. With the core further in, it would be closer to L_{core}, and with the core further out, it would be closer to L_{air}. In designing a variable inductor, the target value of inductance should fall somewhere between these two extremes, so that the coil would be properly tuned, only when a certain fraction of the core were located within it. Assuming that the coil and core are of equal length, the target value is usually obtained when the core is half in, and half out of the coil.

Thus the main problem in designing a variable inductor is one of finding an equivalent L_{air} such that a target value of inductance (which from now on, we'll designate as L_o) may be achieved when a core of known permeability has a certain fraction of its length (c) inserted into the coil. The solution to the whole matter is made as painless as possible with the aid of the graph of **Fig. 2.** This graph, along with the equation from which it is derived (included for the interest of mathematically-minded readers) is the result of the author's research aimed at determining the relationship between these factors.[6] The graph shows the variation of an inductance L_o as a function of it's inserted core fraction c, between values of L_{air} and L_{core} corresponding permeabilities between 1 and 10. It is "normalized" (in that the value of L_{air} is always considered to be 1.00, and values of L_o are indicated as multiples of it) so that it may

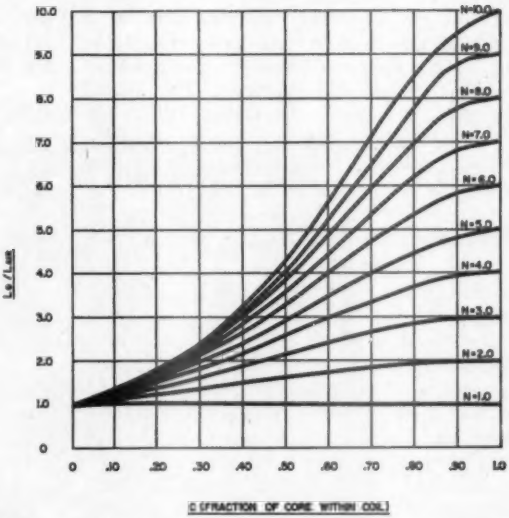

Fig. 2. The inductance variation of a permeability-tuned coil as a core is inserted into it. The equations used in the preparation of this graph are given in the appendix at the end of the article.

be used to design coils of any particular inductance value by means of ratios. To see how it works, let's take an example:

Suppose we want to design a coil which will have an inductance of 20.0 μH when a core is inserted half-way into it ($c = 0.500$), and the permeability of the core we wish to use is 9.00. Find the point on the graph's horizontal axis corresponding to $c = 0.500$, and move directly upward to intersect the curve marked "$\mu = 9.00$". Then move directly across to the vertical scale and read off the multiple of L_{air} corresponding to the point of intersection. In this case it is 4.00. This tells us that when a slug with $\mu = 9.00$ is inserted halfway into a coil, the resulting inductance is always 4.00 times the coil's air-core value.[7] The next step is to take the reciprocal of this multiple and multiply it by our target value; that is, if $L_e/L_{air} = 4.00$, then conversely, $L_{air}/L_e = 0.250$, and the equivalent air-core inductance we're looking for is equal to 0.250 x 20.0 μH = 5.00 μH.

Having found L_{air}, we're over the major hurdle, and the rest is downhill. As in the design of fixed-value inductors, it consists of noting the length of the slug, the diameter of the coil form, and making the appropriate calculations with the coil-winding formula and a wire table, to find the proper number of turns and wire. In a similar manner, Fig. 2 can be used to design coils of other values. Should it be desirable that the target inductance occur at some inserted core fraction other than ½, simply locate the corresponding value of c on the horizontal and use it to find the intersection point on the appropriate permeability curve. Likewise, to use a core with a permeability other than 9.00, simply intersect the curve corresponding to the new value. The graph is plotted for integral values of μ between 1 and 10 (the range of most junkbox slugs). Fractional values may be interpolated from these, but the ratio L_{air}/L_e for μ greater than 10 must be calculated directly from the accompanying equation.

Accuracy

The procedures and data presented here are intended to help provide a systematic basis for further amateur research on inductance; they could be greatly refined in many ways, and by no means represent an exhaustive survey of the possibilities of ferrites. Three limits to their accuracy should be noted in particular; first, in the case of variable inductors, is the graph of Fig. 2. While it greatly simplifies calculation, it is only accurate within about 5%. Second is the limit within which the core permeability is known. Without laboratory quality instruments, or well-calibrated test equipment, it is difficult to reduce measurement errors to less than 5-10%. Third, the entire procedure is limited by the accuracy of the coil-winding formula, which is, in itself, only an approximation. While it is normally con-

sidered to be reliable within 1%, it becomes increasingly inaccurate as the ratio of a coil's length to diameter approaches 1, or as the wire diameter becomes an appreciable fraction of the coil diameter. The overall accuracy will usually be within 10-20%-sufficient for most amateur work—but don't expect miracles; accurate results demand accurate data.

Suggestions for further research

This article has been prepared in the hope of stimulating further amateur experimentation and development, to help meet the need noted in the introduction. The commercial applications of ferrites have become increasingly widespread as professional designers have begun to learn their characteristics and realize their tremendous potential. Unfortunately, little of the knowledge thus gained has as yet filtered down to experimenters in simplified, semi-technical form, applicable with a minimum of advanced math. How, for example, can one determine the method of winding a ferrite coil so that it tunes linearly—such as one for a VFO? Or, consider the problem of designing a coil using a brass slug; it's been done, but how? How does one design a toroidal coil? Is there a simple, predictable method of designing self-resonant coils for VHF? Any solutions a curious ham can find for these, or other inductance problems, would be welcomed by the rest of the fraternity, and 73 would certainly like to hear about them.

In the meantime, here's enough information to get you started, so what d'ya say we get out those slide rules, scratchpads, soldering guns, and *design* some coils! ■

Appendix:

Equation: $$\frac{L_{air}}{L_o} = \left[\left(1 - \frac{1}{\sqrt{\mu}}\right) (1 - e)^2 + \frac{1}{\sqrt{\mu}} \right]^2$$

If $e = \frac{1}{2}$, the equation simplifies to:

$$\frac{L_{air}}{L_o} = \frac{(\sqrt{\mu} + 3)^2}{16\mu}$$

Note: Valid *only* for cylindrical, linearly-wound coils, whose dimensions equal those of the core being used.

1. The approaches to be outlined above were developed independently, as part of a high school physics research project, and have not, to my knowledge, appeared elsewhere in print. If, however, I should happen to infringe on previously published material, I apologize, and would be pleased to acknowledge it.
2. And, therefore, as previously noted, the dc resistance per unit inductance is reduced, and the Q, its reciprocal, is raised.
3. Only single-layer, cylindrical, linearly-wound coils are considered here, since they are the ones most often encountered in amateur work. For multi-layer, progressively-wound, or other kinds of coils, the appropriate winding formulas should be used instead.
4. L is the coil's inductance, in μ H; r, its mean radius (in inches); N, the number of turns; and *l*, its length (also in inches).
5. Practical tip: hold the windings in place with coil dope or Duco cement.
6. Readers interested in the mathematical development of the above equations, or the derivation of *Fig. 2*, should write to me, enclosing a sase; if there is enough demand, I can prepare a mimeo sheet detailing the process.
7. Note again, that the graph is valid only for single-layer, cylindrical, linearly-wound coils, whose dimensions correspond to those of the core.

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In a previous article[1], the author described a 10-20 meter FET converter which was to become part of the front-end of a 10-160 meter transistorized receiver. The results were sufficiently encouraging to warrant building a modified version, covering 40 and 160 meters. Eventually, the two converters will be combined with an 80 meter FET tuner, which is still in the breadboard stage, for coverage of the six high-frequency amateur bands.

Design

The converter schematic is shown in Fig. 1. A Motorola 2N4224 is used as the rf amplifier, while an MPF105 is used as the mixer. The local oscillator is a 2N1180. An attempt to use an MPF105 as the rf amplifier resulted in an unstable stage. Perhaps more attention to lead length and dress would have tamed the stage, but this was not investigated. A pair of 1N100 diodes is con-

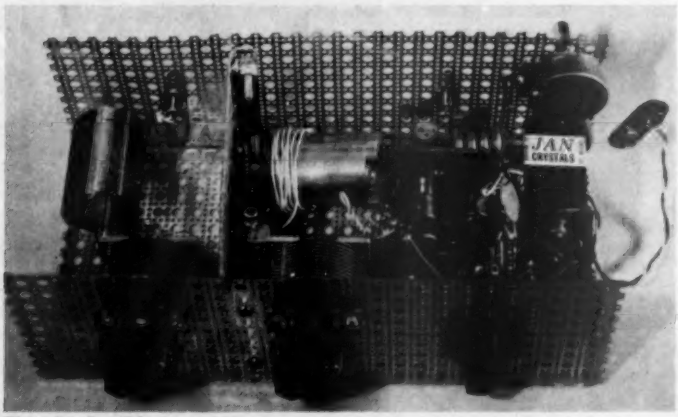

Photo by Joe Cohen

Top view of the FET converter for 40 and 160 meters.

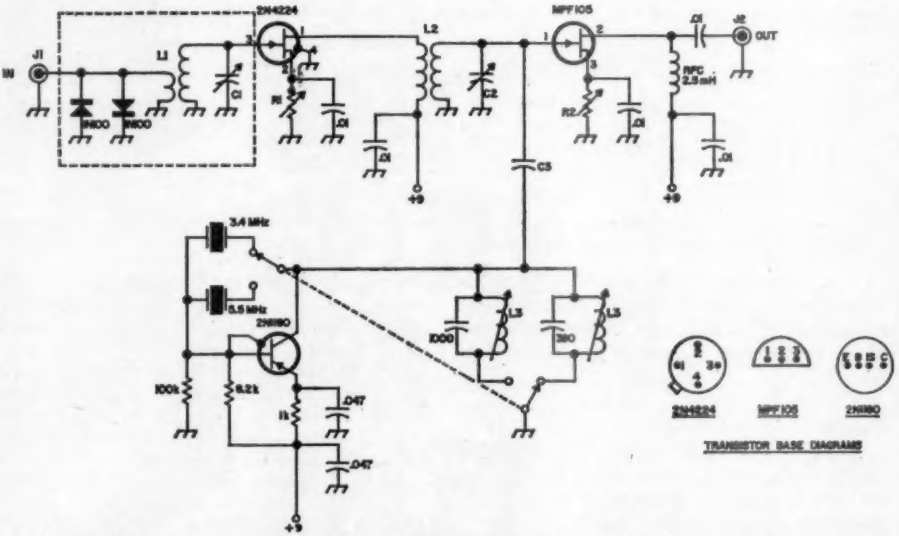

Fig. 1. Schematic diagram of the 40 and 160 meter converter. Field effect transistors are used in the rf amplifier and mixer stages, a bipolar device in the crystal-controlled oscillator. Tuned circuit values are given in Table 2.

nected across the converter input to prevent excessive rf voltages from being applied to the 2N4224 while transmitting.

While there is some question as to the need for an rf amplifier at frequencies below about 10 MHz, one was included, principally to minimize local oscillator radiation by way of the antenna. However, if the converter is to be used with an *if* other than 80 meters (as described later), an rf amplifier may be helpful in reducing image response, depending on the *if* chosen.

The difference between the 10-20 and 40-160 meter converters lies in the rf amplifier, mixer, and local oscillator tuned circuit constants and the local oscillator injection frequencies. The values shown in **Fig. 1** are appropriate to tune the rf amplifier between 1.8 and 7.3 MHz and to provide the injection frequencies required to heterodyne 40 and 160 meters to 80 meters. With the crystals specified, 160 meters is tuned between 3.7 and 3.5 MHz, and 40 meters is tuned between 3.7 and 3.9 MHz on the 80 meter *if*. Note that if 7.0 MHz is hetrodyned to 3.5 MHz, and the 40 meter band is to be tuned "frontwards", an injection frequency of 3.5 MHz is required, and the local oscillator will interfere with reception on the low end of the band.

Use with *if's* other than 80 meters

For several weeks the 10-20 and 40-160 meter converters were used with a BC-453 as the station receiver at K6DQB. The hook-up used is shown in **Fig. 2.** In this case, an extra crystal(s) is used and 80 meters, as well as 40 and 160 meters is heterodyned to the *if* tuning range of the BC-453 — 220 to 550 kHz. The 80-meter range of the low-frequency converter is used as the *if* for the high-frequency converter for 10-20 meter reception. A table of local oscillator coil and crystal requirements is shown in **Table 1.** With the injection frequencies shown, coverage of 10 meters is incomplete. Two additional crystals, 3.9 MHz in the low-frequency converter, and 25.5 MHz in the high-fre-

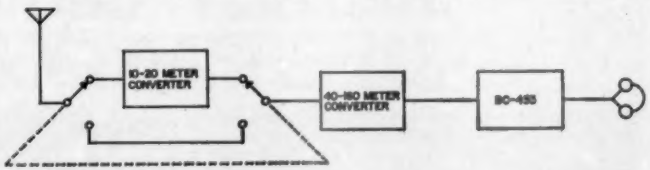

Fig. 2. The two converter —BC-453 receiving arrangement. The 10, 15 and 20 meter converter was described in the May issue of 73.

Table 1 Local oscillator coil and crystal requirements for an *if* of 220 to 550 kHz

Frequency Range	Oscillator Coil	Tuning Oscillator Padder Capacitor	Injection Frequency
7.0 - 7.3 MHz	15 turns	330 pF	6.8 MHz
7.3 - 7.0 MHz*	15 turns	330 pF	7.5 MHz
3.5 - 3.8 MHz	36 turns	390 pF	3.3 MHz
3.8 - 4.1 MHz	36 turns	390 pF	3.6 MHz
2.0 - 1.6 MHz	26 turns	1000 pF	2.2 MHz

*This arrangement is recommended for the CW operator since it provides a higher *if* at the low end of the 40 meter band for better image rejection.

quency converter, would provide the necessary heterodyning frequency combinations required for full coverage. Since the author has not tried this, no values are specified in the table.

Results

As with the 10-20 meter converter, the results with this converter have been pleasing. In particular, susceptibility to cross-modulation appears very slight.

. . . K6DQB

1. "A Field Effect Transistor Convertor For 20, 15, and 10 Meters", K6DQB, *73*, May 1967. The reader is referred to that article for design considerations and lay-out.

Table 2. Tuned circuit values.

C1, C2—15-409 pF variable (Allied Radio 43A3524)
C3 —Two 1-inch lengths of insulated hookup wire twisted together.
L1 —Primary, 6 turns number 24, 32 TPI, 1-inch diameter (B&W 3016). Secondary consists of 40 turns number 24, 32 TPI, 1-inch diameter, spaced one turn from primary.
L2 —Primary, 7 turns insulated hookup wire closewound on cold end of secondary; secondary same as L1.
L3 —25 turns number 30 enameled wire, closewound on 1/4-inch slug-tuned form (Miller 20A000RBI).
L4 —Same as L3, except 36 turns.
R1, R2—10 k potentiometer. Adjust for stable operation and replace with fixed resistors.

Tape Recording QSO's

After you have finished that QSO with mother ham half-way around the world, how many times have you wanted to relive it again at a later time? Thanks to the development of the modern tape recorder, this is easily done. You can wire a recorder into the station gear. Hooking it up is no real problem. Most recorders now on the market have an auxiliary input which is designed to provide a good match when recording directly from radios and record players or transcribing from other tape recorders. I have found that the best method is to tap into the input side of the volume control of the receiver and run this to the auxiliary recorder input. You can also record from the phone jack or speaker terminals, but a direct physical connection to the volume control gives better control and mobility.

Should you want to record both sides of a QSO, simply put a relay into the circuit; then you can have both transmissions on one continuous tape. Hook the relay in parallel with your antenna relay so that when you are listening the relay switches to the receiver and on transmit it switches to your monitor. I always have two receivers in my shack and the secondary one has the antenna grounded so that by carefully adjusting the rf gain I can monitor my own signal. Make sure that all pieces of gear are well bonded together and grounded. Use shielded cable and short lengths—otherwise pickup may cause trouble with the recorder.

To play back the recorded QSO's, start by running the recorder output directly into the mike jack—impedance will vary on different rigs, but by juggling the tape output gain and the transmitter audio gain you should come up with acceptable modulation. Again be sure to use shielded lines and have all equipment well bonded and grounded. If you don't have good results, try some impedance matching coils such as those used in phone patches.

I have been recording ham radio QSO's for the past 10 years and I'm not sorry for a single foot. I have most of the rare DX and the DXpeditions of recent years on tape plus some calls that are no longer on the air. I have been fortunate in being able to ham from three continents and wouldn't trade the tape footage I have for anything.

. . . Ken Bale W7VCB/DL4IO

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West Coast VHF Antenna Measuring Contest

One of the big events at the West Coast VHF Conference in Fresno this year was the antenna measuring contest held on Sunday, May 7th. The weather all during the month of April was terrible, with a lot of rain and little sunshine, but on the conference weekend the VHF'ers were blessed with beautiful clear weather.

The turnout for the antenna contest was tremendous. A total of 47 antennas were measured, 22 for 432 MHz and 25 for 1296. This is the largest number of antennas entered at one of these events, and the contest took all day.

The antenna measuring party this year was improved considerably over past events because of a special reference antenna built by Bob Melvin, W6VSV. This reference antenna is a National Bureau of Standards design which eliminates some of the reflection problems caused by the reference dipole which is normally used.

The antenna with the highest gain in the 432 MHz contest was K6MIO's 8-foot dish with a homemade extension to 12.5 feet[1]; the measured gain was 16.9 dB. Next, at 16.2 dB, was K6HAA's 32-element expanded-extended collinear, originally designed by Oliver Wright, W6GD. Then, third down, was K6MIO's cylindrical parabola with a 7-dipole collinear feed[2] at 13.2 dB. Following the top three were several Tilton 11-element Yagi's[3] measuring from 11.5 to 13.0 dB, a W2CCY Yagi at 11.0 dB, a commercial 16-element collinear at 10.3 dB, K6MIO's 7-dipole collinear feed (without parabola) at 9.7 dB, and a 14-element J slot, a 90° corner reflector, a 4-foot Lafayette UHF TV parabola with dipole feed, and a 9-element quad, all at 8.2 dB. Lower gain antennas included assorted Yagi's, a dipole of "questionable match", corner reflectors, a large half horn and a small four-foot UHF TV dish.

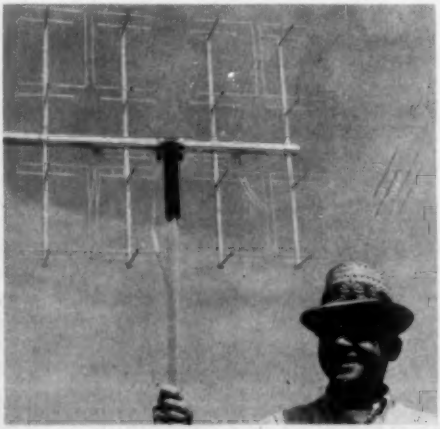
The dishes led the field in the 1296 contest with WB6IAG's four-foot TV dish with ½-inch mesh at 17.3 dB, K6MIO's 12.5-foot dish at 17.1 and 16.8 dB (standard dipole and WB6IAG feeds respectively), WA6MGZ's four-foot TV dish covered with aluminum foil at 16.2 dB (16.3 dB with WB6IAG's feed), and K6HCP's four-foot TV dish with ¾-inch mesh at 15.6 dB (16.3 dB with WB6IAG's feed). It is interesting to note that WA6MGZ's dish measured only 12.4 dB when the foil was removed.

Following the parabolas were W6GD 32-element extended-expanded collinears: WA6GYD's at 14.2 dB, W6GDO's at 14.0 dB and W6BUR's at 12.8 dB. Then, K6HMS's solid aluminum horn at 11.5 dB, W6ZOP's half-horn monster at 10.1 dB, WB6IOM's 24-turn helix at 8.2 dB, K6HOU's "clean-sweep" Yagi at 7.8 dB, WA6KKK's 60°

K6HOU and his "clean-sweep" Yagi's for 432 and 1296 MHz. The 8-element job on top measured 7.8 dB; the 6-element unit below, 7.2 dB.

horn at 7.5 dB, and WA6NCT's zig-zag antenna, stock UHF TV antenna and coffee-can antenna at 7.0, 5.1 and 3.1 dB respectively. A brass dipole and inverted discone, both brought by W6GDO, measured −2.0 dB.

If you look at the records from the various contests down through the years, you will notice that certain types of antennas are consistent winners. On the west coast for example, the W6GD extended-expanded collinears always end up in the first few places on 432 MHz, and, they usually win. However, they are more prevalent in Northern than in Southern California, hence, there was only one entered in this test in Fresno.



W6BUR's silver-plated 32-element extended-expanded collinear measured 12.8 dB on 1296 MHz.

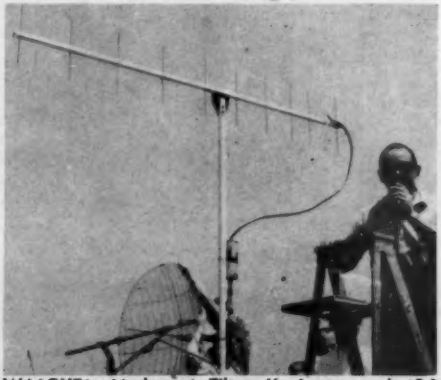
Since the contest rules state that the antenna must be held and aimed by one man,

K6HAA's 32-element extended-expanded W6GD collinear measured 16.2 dB. The small four-foot dish in the background was tested at 1296.

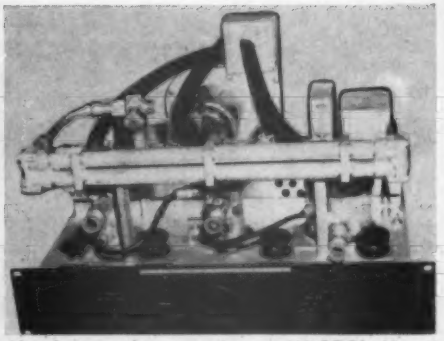
K6MIO's 12.5-foot dish measured 16.9 dB at 432 Mhz. This dish consists of an 8-foot surplus with a homemade extension which brings it out to a 12.5-foot diameter.

parabolas don't make out too well on 432. On 1296 it's a different story, since it's fairly easy to hold and aim a 20-dB dish.

After the W6GD collinears and dishes come the Yagi's, usually a good three dB down the totem pole. And, of all the Yagi's, the design by Ed Tilton, W1HDQ, seems to be the most reproduceable and consistent in gain. Some other Yagi's have done about as well as the Tilton design, but not consistently. And, to my knowledge, a Yagi has never won the West Coast affair.



WA6GYD's 11-element Tilton Yagi measured 12.8 dB gain at 432 MHz. Note the beer-can balun and folded-dipole radiator.



Also shown at the convention was W6GDO's 60-watt SSB transmitting converter assembled from surplus DME (distance-measuring equipment).

There is one other interesting facet to these antenna measuring contests—the absence of commercial antennas. The reason of course is that they just don't perform as well as the homemade units on these frequencies. Usually one or two will show up at the contest, but when the dust has all settled, they are well back in the pack, and their owners go home sadder but wiser.

Although the measurements made at these antenna measuring parties are reasonably accurate, there are many problems involved. The West Coast group has conducted them for a number of years, and each year the accuracy improves slightly. This year the use of a standard-gain antenna instead of a reference dipole improved matters considerably. Next year the group is planning on using a cherry picker or mobile mast to hold the signal source about forty feet off the ground. With this type of source mounting, the test antennas can be aimed upward over the horizon at an appreciable angle, further reducing problems with ground reflections, one of the big bugaboos of measuring antenna gain. However, considering all the vagaries in measuring gain, the West Coast group has come a long way since their first contest a few years ago. This is borne out by the fact that the gain figures for the same antenna remain pretty consistent from one year to the next.

. . . W1DTY

1. K6MIO, "Illumination and Parabolic Antenna Design", *73 Magazine*, December 1966
2. K6MIO, 'Big Sail for 432", *73 Magazine*, August 1965.
3. Tilton, "Yagi Array for 432 Mc.", *QST*, April 1966.

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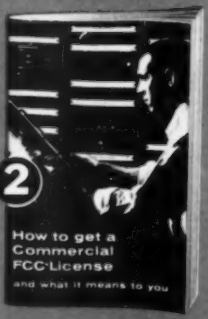

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Business is booming. August Gibbemeyer was in radio-TV repair work before studying with CIE. Now, he says, "we are in the marine and two-way radio business. Our trade has grown by leaps and bounds."

Louis Hutton K7YZZ
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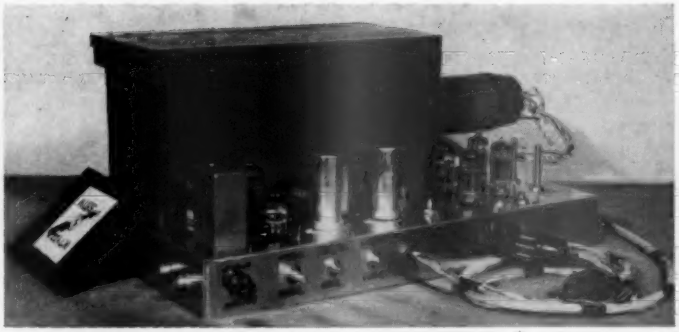
A Slow-Scan Television Picture Generator

Introduction

The author became interested in Slow Scan TV (SSTV), after having experimented with Fast Scan TV[1], as a means to extend the range of picture transmission. The reception and transmission of SSTV was observed at Bob Gervenack's station (W7FEN) during the recent FCC authorized tests on twenty meters[2]. The clarity and detail of the pictures observed, considering the bandwidth of the transmitted signal, were quite impressive. In fact, the author immediately began construction of a SSTV monitor[3]. The monitor was completed three weeks later, and has performed satisfactorily when displaying SSTV signals received on local VHF tests. The SSTV subcarrier frequency modulated (SCFM) signal as proposed by Macdonald[4], is essentially a 1500 Hz voltage controlled audio subcarrier, shifted down periodically to 1200 Hz for sync information, and then varied from 1500 Hz (black) to 2300 Hz (white) for the video information. One complete picture is sent every eight seconds.

The next step was to construct a unit which would be capable of sending SSTV pictures. Several articles describing SSTV camera equipment were reviewed.[5,6,7] The vidicon camera looked interesting, but the non-availability of the special vidicon required for the unit discouraged that approach. The most feasible and easily constructed type appeared to be a Flying Spot Scanner. No article could be located which provided complete information and schematics on the construction of a Flying Spot Scanner for SSTV. The unit described in this article is based on portions of the circuits combined to provide for the generation and transmission of positive pictures and sketches.

The slow-scan television generator and monitor built by K7YZZ. Although the use of this equipment is presently limited to six meters and up, SSTV tests on 20 meters with KC4USV in Antarctica have resulted in a recommendation to the FCC that SSTV be permitted on the HF bands.



The slow-scan television picture generator. The cathode-ray tube and photo-multipliers are housed in the light-tight box on the rear of the chassis.

How it works

In the block diagram of **Fig. 1**, a raster is painted electronically on the end of the cathode ray tube by vertical and horizontal oscillators and amplifiers. The light from the raster is focused on the photograph to be transmitted. Reflected light from the picture is detected by the two photomultiplier tubes, and is converted into a weak dc signal.

This signal is amplified by the photomultiplier tubes, and the output is connected to the modulator which shifts the voltage controlled subcarrier oscillator from 1500 Hz to 2300 Hz, depending upon the level of light falling upon the photo cells. Sync signals from the vertical and horizontal oscillators are combined in the sync mixer, and the resultant composite sync signal is connected to the modulator which shifts the subcarrier down to 1200 Hz. The horizontal sync pulse is a burst of 1200 Hz 5 milliseconds long, and the vertical sync pulse is 30 milliseconds of 1200 Hz. The audio subcarrier output is connected to the microphone input of the transmitter through the monitor.

Construction

The SSTV Flying Spot Scanner is constructed on two chassis for ease of handling and to keep the power transformer magnetic field as far away from the cathode ray tube as possible. The five-wire cable supplies power to the cathode ray tube filament and high voltage. The six-wire cable supplies filament and low voltage to all other tubes.

The electronics portion of the unit (**Fig. 2**) is mounted on a 10″ x 17″ x 2″ aluminum chassis. The box containing the photocells, lens, and cathode ray tube is 6″ x 12″ x 5½″ and is constructed of 3/16″ thick mahogany. The inside is sprayed with dull black acrylic paint. A small door, 5″ x 5½″, is fitted in the end opposite from the cathode ray tube face. Two small metal clips were fabricated and mounted on the inside of the door to hold the photograph as it is being scanned by the light beam.

An aluminum divider (painted dull black), to hold the lens and seal the photocell compartment from the cathode ray tube compartment, was constructed so that it would just press fit between the two box

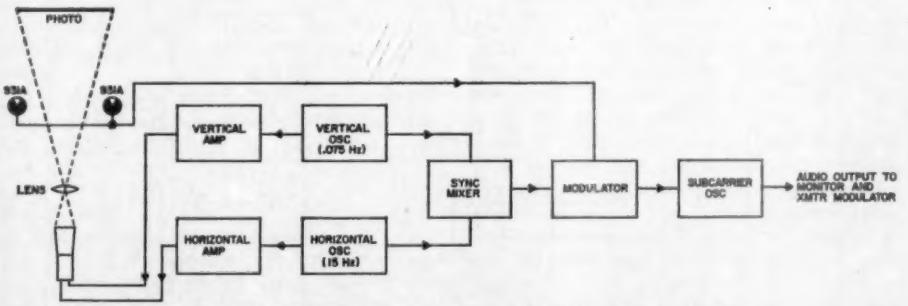


Fig. 1. Block diagram of the slow-scan television picture generator built by K7YZZ.

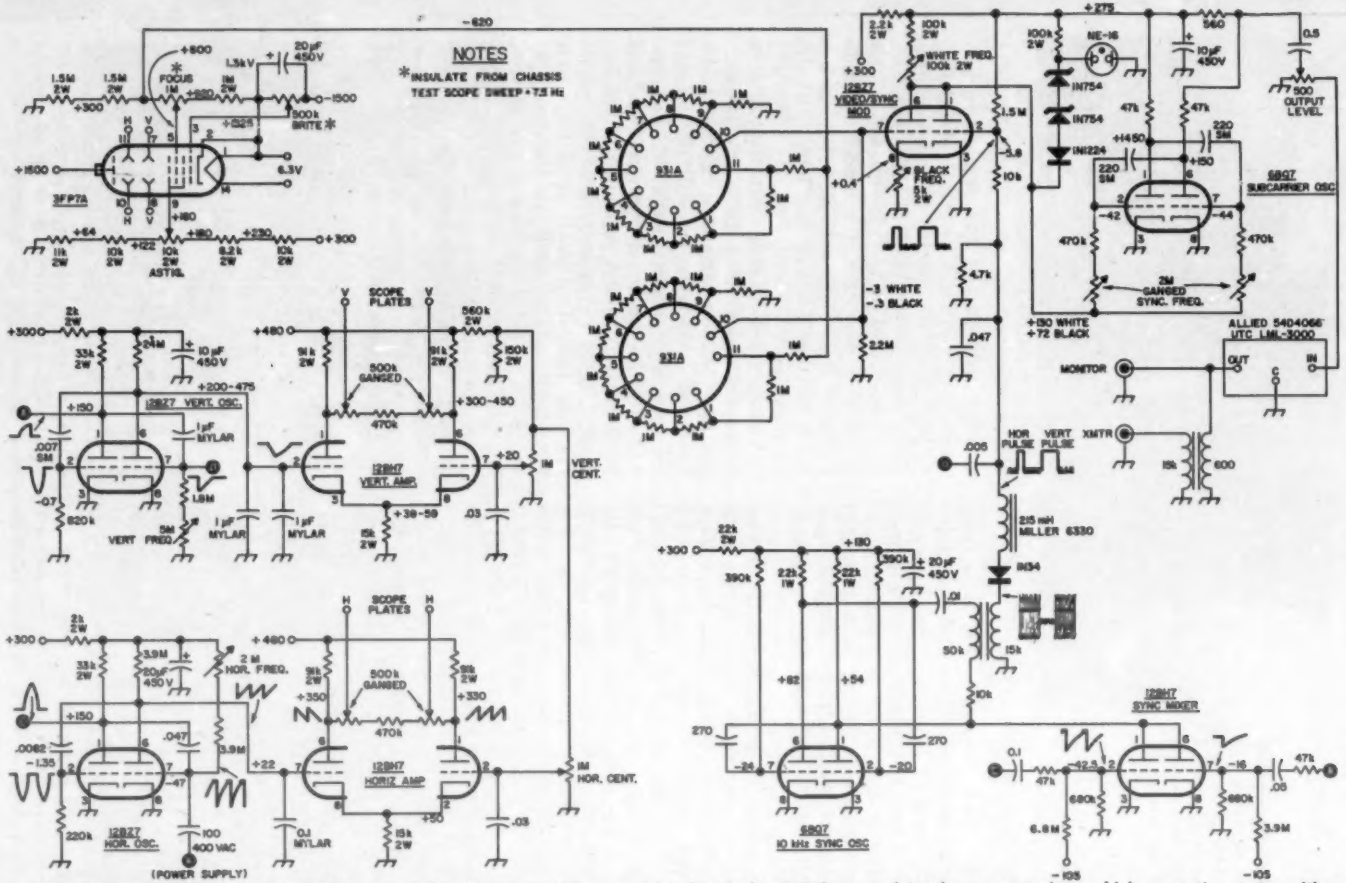


Fig. 2. Schematic diagram of K7YZZ's SSTV generator. The dc voltages associated with the CRT focus and brightness controls should be negative, not positive as shown. The 50k:15k transformer in the plate circuit of 6BQ7 10 kHz sync oscillator is a Knight 54D1458. The 600:15k output transformer in the transmitter line is a Knight 54D2023.

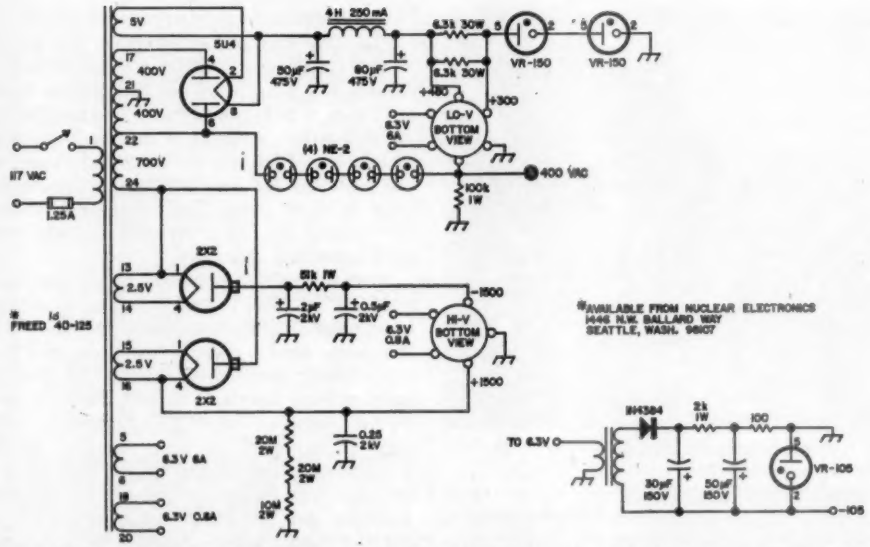


Fig. 3. Schematic diagram of the power supply for the SSTV generator. Watch the filter capacitors in the negative supplies—their polarity is reversed.

side walls. The lens originally used was installed on a home made fast scan vidicon camera. It is a F1.9, 48mm lens, and is available from Denson Electronics, Rockville, Connecticut. Their part number–3800 (lens) and 3801 (mounting ring).

The two photocells are mounted on ¾" metal standoffs which are located on each side of the lens assembly, just forward of the aluminum divider. A piece of masking tape, 1" x ½" is taped over the photocell window (grid wire), and the tube is sprayed with dull black paint. When the paint is thoroughly dry, the masking tape is removed to expose the window. The photocell is mounted to that the window faces the photograph on the door. The bottom for the wooden box is provided by the aluminum chassis. That portion of the chassis covered by the box is painted dull black.

The wiring of the unit is not tricky as the highest frequency is only 2300 Hz. Wiring practice applicable to hi-fi audio work is satisfactory.

Adjustment

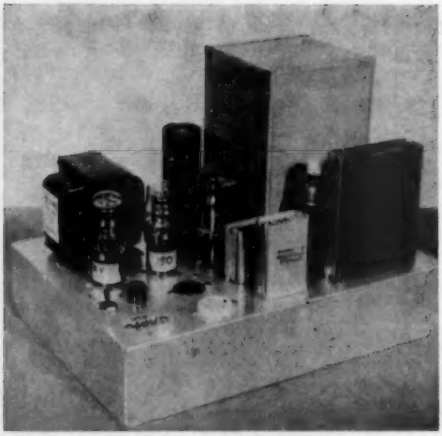
Typical voltage and waveform data are shown on the schematics. The raster on the 3FP7 was adjusted to a square format approximately 1¾" x 1¾". The 3FP7 is mounted so that the high voltage contact button on the side of the tube is at the top. Connections to the vertical deflection plates provide for a sweep from bottom to top, and the horizontal deflection plates are wired to give a sweep from right to left, as viewed on the 3FP7 tube face. The metal divider holding the lens may be moved to provide a rough adjustment of optical focus of the beam on the photograph, and fine focus is provided by the lens assembly mechanical focus system.

Sync frequency adjustment is accomplished by grounding pin #2 of the 12BZ7 video/sync modulator, and adjusting the sync frequency control so that the subcarrier oscillator output is 1200 Hz. Remove the ground from the #2 pin.

The black frequency is set by turning the 3FP7 brightness control down, until the raster fades out. The box is closed with no picture on the door. The black frequency control is adjusted so that the subcarrier oscillator output is 1500 Hz.

An all white card is now placed on the door, and the door closed. The 3FP7 brightness is advanced slowly, until a bright raster is painted on the face of the scope tube. The white frequency control is adjusted so that the subcarrier oscillator output is 2300 Hz.

All surplus 931-A photo tubes may not have equal sensitivity. Out of four tubes



The power supply for the K7YZZ slow-scan television picture generator.

tested by the author, one was quite weak, another very sensitive and the remaining two were of average sensitivity. Their sensitivity was determined by plugging them in one at a time and observing the resulting light pattern on the monitor, with no change in the 3FP7 brightness control after initial adjustment. If two tubes of near equal sensitivity cannot be obtained, the negative voltage to the more sensitive tube will have to be reduced to keep the gain of both tubes equal.

It has been found that messages or drawings, made with black ink marking type pens on a white matte finish paper, make fine test prints. Glossy photographs, such as Polaroid camera shots, are satisfactory but the shiny, slick finish may cause a light burn on parts of the reproduced pictures as seen in the monitor, unless the photograph is treated with a glare reducer such as "Krylon Dulling Spray" No. 1310.

Miscellaneous

The low-pass audio filter in the output of the subcarrier oscillator was added to restrict the bandwidth of the system when used with a SSB transmitter. The multivibrator subcarrier oscillator is rich in harmonics, which would cause undue interference on our crowded HF bands. A more economical type of low pass filter, designed around the readily available 88 mH toroids, may be substituted.

Although at the present time, the general use of SSTV transmission is limited to the six meter band and up, the FCC has authorized special testing of SSTV in the amateur service on the 40, 20, and 15 meter phone bands. The tests will be conducted between KC4USV, Antarctica, and suitably equipped amateur stations in the Continental United States. It is hoped, in the not too distant future, that complete authorization for general use of SSTV on the HF bands will be given. In the meantime, now is the time to get the equipment built and tested.

The author wishes to thank Bob Gervenack, W7FEN, and Copthorne Macdonald, WAØNLQ, for their technical support in this project.

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2. *QST*, September 1966, p. 38.
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4. Macdonald, "S.C.F.M.—An Improved System For Slow Scan Image Transmission", Part 1, *QST*, January 1961.
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7. Macdonald, "A New Narrow-Band Image Transmission System" *QST*, September 1958.

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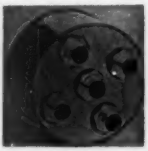

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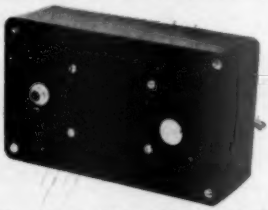

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VHF Log-Periodics and the "Log -Scan 420"

If you have been planning an antenna system for the VHF or UHF bands, you shouldn't overlook the log-periodic array. This antenna features high gain, wide bandwidth and reproduceability.

The new look in antennas is here. Soon VHF log-periodic antennas will be replacing yagi arrays of practically all types, and also replacing old standbys such as the collinear, helix, and corner reflector. This revolution has already been taking place in the television antenna business for several years and there are good reasons why.

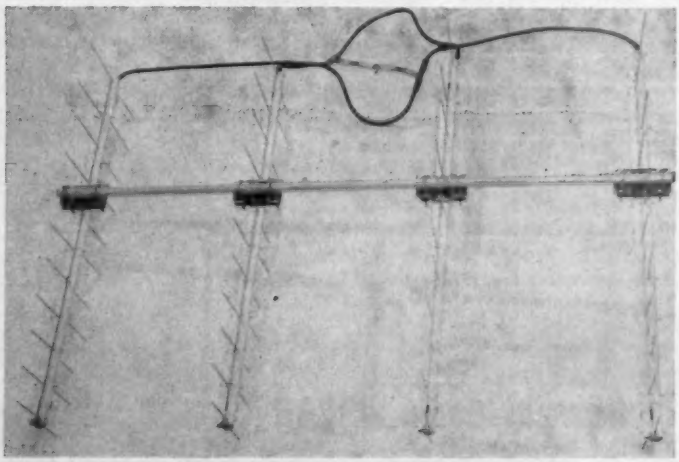
First of all, do not be led astray on the subject of gain. Not many people interested in antennas presently know that log-periodics having about 1.5:1 bandwidths can deliver just as much gain as yagis the same size and having only a few percent bandwidth. This, as well as other new data, has been accumulated in the last few years and the properties of the planar (flat) log-periodic have been under investigation recently. Only lately has it become evident that log-periodics with small apex angles can yield as much as 12 dB gain.

Construction details of the "Log-Scan 420" are presented later in this article. This antenna serves as an excellent example of the advantages of the log-periodic. Here is a summary of its characteristics:

a. Gain: 16-17 dB over an isotropic.
b. Bandwidth between 1.5:1 SWR points: 50 MHz.
c. Size: 14¼" wide, 65" high, 41" deep.
d. Input impedance: 50 ohms unbalanced.
e. Matching section or tuning adjustments necessary after construction: *none.*

As you can see, the antenna is ideal not only for general work on 420, but is just the thing for the ever-growing amateur television fraternity. Let's compare it with its nearest competitor, the yagi.

A stacked array of four yagis of the same overall size would have 1.5λ length booms, seven to nine elements per yagi, and each yagi would exhibit about 11 dB gain. With a stack of the above dimensions, a gain increase of only 4-5 dB would result because some aperature overlap occurs. However, even with fullwave stacking (height of 80"),



The "Log Scan 420" array built by K4GYO. Each antenna in this array exhibits about 11.5 dB gain; the entire array yields about 17 dB.

a total array gain of over 16.5 dB is unlikely. Advantage of the yagi in gain: little or nothing.

Mechanically, the yagi has the advantage of fewer booms and elements, but from every other standpoint, the log-periodic array has the upper hand. For instance: a 50 MHz bandwidth, compared to a 1 to 2 MHz bandwidth of the yagi. Even with special techniques, bandwidth of more than 10 MHz for the yagi array cannot be achieved without going to twin- or triple-driven elements at the expense of array size and/or gain. Also, log-periodics are not sensitive to tuning effects caused by element and boom diameter. Nor do small (less than 2%) variations in element lengths from those intended have much effect on gain and input impedance. In addition, no balun, delta, tee or gamma match is needed to couple the antennas to the coax phasing harness or feed line. The log-periodic design can be adjusted to provide a good match directly to coax of any impedance; this eliminates any tuning or pruning, and effectively reduces the weatherproofing problem to zero. More about these factors later.

What advantages does the planar log-periodic offer over dishes and corner reflectors? One word: size. The "Log-Scan" has the gain of a dish 7 feet in diameter, or of any other screen reflector antenna of about the same area. It also has about the same gain as a 32-element collinear 62 inches square. The reason is that, like the yagi, the traveling-wave structure of the log-periodic multiplies the effective capture area it exhibits, to equal a reflector antenna of much larger size (whose capture area approximately equals the reflector area). The simplicity of transmission-line matching doesn't offer too much advantage over the dish or corner reflector, but does when compared to the problems encountered with a 32-element collinear in a high humidity area.

Designing your own

Log-periodics have the extraordinary feature of being truly wide-band structures, with their electrical properties repeating at intervals occuring at a ratio equal to the factor τ, as the frequency is changed. The τ factor is the factor by which the next higher set of elements on the antenna decreases in length, relative to any one set. If, for example, an array had a τ factor of 0.9, and the longest set of elements were 100 inches

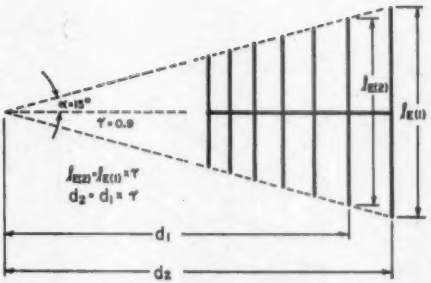


Fig. 1. The planar log-periodic antenna. The τ factor determines the relationship between subsequent element lengths and spacing. The α angle is the apex half-angle shown here. Both of these factors control the available gain of the array.

long, the second set would be 90 inches, the third set, 81 inches, and the fourth set, about 73 inches. The τ factor is usually chosen above 0.7 so the properties of the antenna repeat close enough together percentage-wise so there is no appreciable variation in them. A log-periodic can be made to cover 10:1 frequency ranges or more. However, to cover, say, a 100:1 range, it would be necessary to scale down the diameters of the elements and booms in inverse proportion to the increase in frequency.

The low cutoff frequency occurs when the *longest* set of elements is about 0.47 wavelengths long. The high cutoff frequency occurs when the *shortest* set is about 0.38 wavelengths (for that frequency). If it is desired to maintain gain and pattern closely over all of a given band, the cutoff frequencies should be set 10% below and above the band limits for τ factors of 0.9 and above; 20% for smaller factors.

The α angle is the apex half-angle, as shown in Fig 1. The τ factor and α angle together control the available gain; it being higher for a smaller α angle (which means a longer boom) and a higher τ factor (which means more sets of elements).

It can be seen why an antenna can be duplicated with different element and boom diameters than the original, without affecting the performance. All that will happen is that the high and low cutoff frequencies will be shifted slightly. This factor makes building log-periodics much easier than building and adjusting yagis.

Looking at Fig. 2, it can be seen that the planar log-periodic is actually a balanced transmission line with elements fed from along its length. Notice that each set of

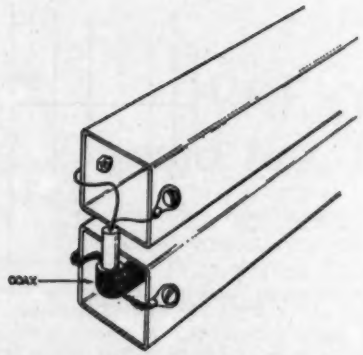


Fig. 2. Method of feeding the log periodic with coaxial feedline. The coaxial line is fed through one of the booms and connected to both.

elements is reversed in feed polarity from the previous set. The antenna will not work unless this is done. The antenna structure is fed at the high-frequency end, and its feed impedance appears somewhat less than the characteristic impedance of the boom structure. It is possible to match impedances from 50 ohms to 200 ohms by adjusting the boom spacing. The only restriction is that low impedances should be used only with high τ factors, although the reverse isn't true.

The L-P balanced structure can be fed by coax, without using a separate balun, by feeding the coax through one of the booms from the back of the antenna. The shield of the coax is connected to the carrier boom only at the very front, and the center conductor is connected to the end of the other boom by the shortest possible path. Currents on the other surfaces of the booms drop almost to zero toward the rear of the antenna, and the boom completely shields the coax from antenna fields along its length. The coax can be taken from the rear of the boom to the mast at about a 45 degree angle, without producing noticeable effect on antenna pattern, or line SWR. Notice that *both* booms must be insulated from the support mast and should be spaced from it by at least twice the gap between the booms.

It should be kept in mind that the smallest possible booms should be used for building VHF arrays, because this will lessen the amount by which the halves of an element set are out of line with each other. The fact that the halves are not directly in line causes some shift in polarization away from horizontal. This can be minimized by using high τ factors and by using square booms with the elements inboard toward each as far as possible. This was done in the "Log-Scan" (see Fig. 9)

The gain is related to the α angle and τ factor as shown in **Fig. 3** on the left scale. Antennas will work with other combinations of α and τ, but these combinations are optimum for maximum gain. **Fig. 3** also allows estimates of the size of an antenna for a given gain and bandwidth.

Let us design a L-P array as an example. Suppose that you wanted to build a fairly high gain L-P to cover 144-225 MHz, including 2 meters, channels 7-13, and 1¼ meters. The antenna is to have as much gain as possible without exceeding a boom length of 10 feet (l_B). First, calculate how many wavelengths at 144 MHz are equal to 10 feet:

$$n = l_B \times f_{lower}/985$$
$$= 10 \times 144/985 = 1.46$$

Then calculate the bandwidth ratio, BW:

$$BW = f_{upper}/f_{lower} = 225/144 = 1.56$$

Then, going to the graph, draw a straight line from 1.56 on the right scale, through 1.46 on the center scale, and find its intersection on the left scale. Roughly, $\alpha = 4.5$ degrees and $\tau = .95$. The gain available is 11.5 dB. This gain is equivalent to a 2-meter yagi of the same length, with a typical bandwidth between 1.5:1 SWR points of 2 MHz —not even enough for the whole amateur band!

The next step is to calculate the longest element length. This length , l_{EL}, is equal to 0.47 at the lower cutoff frequency:

$$l_{EL} = 0.47 \times 985/f_{lower}$$
$$= 0.47 \times 985/144 = 3.22 \text{ feet}$$

The second set of elements has a length of:

$$l_{EL} = l_{EL} \times \tau$$
$$= 3.22 \times 0.95 = 3.06 \text{ feet}$$

The rest of the element lengths are calculated in turn by multiplying each length by τ to obtain the next length. To know how many sets are needed, calculate the ideal shortest element, l_{EL}; equal to 0.38 τ at the high cutoff frequency:

$$l_{EL} = 0.38 \times 985/f_{upper}$$
$$= 0.38 \times 985/225 = 1.66 \text{ feet}$$

Then continue the original table of elements until a length of less than 1.66 feet is reached. This is the shortest element needed (don't necessarily use 1.66 feet).

To determine the location of each element, start by determining the distance d_1 from the longest (and rearmost) element,

to what would be the apex if the frequency coverage extended to infinity (see **Fig. 1**):

$d_1 = l_{80}/2 \times \text{cotangent } (\alpha)$

(where $\alpha = 4.5°$)

$= 3.22/2 \times 12.77 = 20.59$ feet

The second element will be a distance d_2 from the apex:

$d_2 \; d_1 \times \tau$

$= 20.59 \times .95 = 19.55$ feet

The table is continued, the same way as the element length table was, until finished. The last distance subtracted from 20.59 feet gives the exact boom length needed, except for adding perhaps a half inch at each end to hold the end elements. This won't be exactly 10 feet, but can be adjusted by changing τ a small amount and recalculating both distances and element lengths.

Next, choose a transmission-line impedance. If, for example, you decide on 50 ohms, a value of about 60 to 100 ohms should be tried for the characteristic impedance of the boom structure. The spacing will be much less than the boom width in this case. Decide what the smallest boom diameter is that is practical to use, and, fit your coax through. For circular booms, the approximate spacing can be found from a table in most handbooks showing the characteristic impedance of parallel-wire lines as a function of relative spacing. If square booms are used, you may have to guess a little, because, as yet, I haven't been able to find a formula for the impedance of square-conductor transmission lines. I have found by experiment that spacing of about 20% of the width of a square boom, gives a characteristic impedance close to 50 ohms for the finished antenna.

If it is desired to stack a pair of the antennas such as just designed, the coax should have impedance close to 100 ohms (91 ohms), and the boom structure should end up being between 110- and 180-ohm characteristic impedance. The coax cables are then brought out equal distances from the rear of each boom, and joined in a tee connector. The lengths of the individual cables are unimportant, so long as they are equal, in order to maintain proper radiation phasing. At this junction, the feed impedance will be close to 50 ohms. This combining method is, of course, frequency-independent and can also be used with three or four stacked antennas if 150 or 200 ohm coax can be obtained (those available may be relatively lossy). All feed lines should be the same

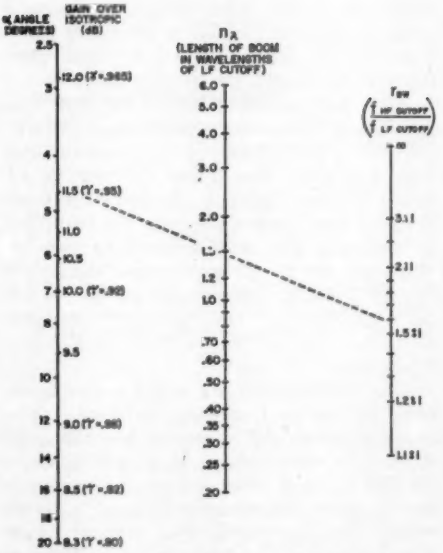

α ANGLE DEGREES
GAIN OVER ISOTROPIC (dB)
D_A (LENGTH OF BOOM IN WAVELENGTHS OF LF CUTOFF)
τ_{SW}
$\left(\frac{f \text{ HF CUTOFF}}{f \text{ LF CUTOFF}}\right)$

Fig. 3. Design nomograph for log-periodic antennas. When the bandwidth ratio is known ($f_{HF\ cutoff}/f_{LF\ cutoff}$), the length of the boom, α angle and gain over an isotropic can be found. For example, for an L-P for 144 to 225 MHz, the bandwidth ratio is 1.56. A boom is available which is ten-feet long (1.46 λ at 144 MHz). What α angle and τ factor are required? The dotted line indicates an α angle of 4.5 degrees and τ factor of 0.95; gain is approximately 11.5 dB.

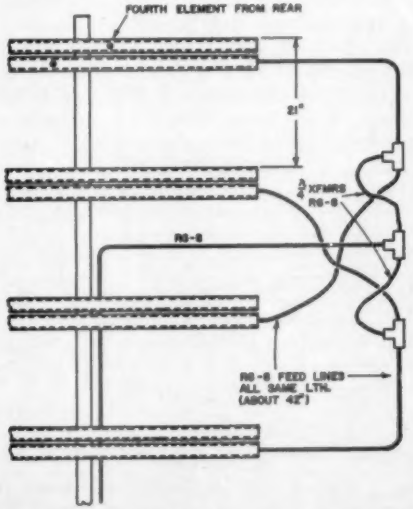


Fig. 4. Feed harness for four stacked log-periodic antennas using RG-8/U coaxial cable.

type, exactly the same length, and should all be hooked in parallel at the same point. The formula for paralleled resistors gives the driving impedance at this point.

With L-P arrays designed for less than 20% bandwidth, ¼-wave matching transformers can be used instead of the above method. The "Log-Scan" has all four L-P sections adjusted for, and fed with, 50-ohm coax. Then the feed lines are tee'd together in two pairs, as shown in **Fig. 4.** The resulting two impedances of 25 ohms are fed through ¼ wave, 50 ohm transformers to obtain two 100 ohm impedances. These are paralleled again in a third tee, getting us back to 50 ohms again.

The stacking of L-P's and the results obtainable are fairly similar to the stacking of yagis. With L-P's having less than 20% bandwidth, all sections can simply be made parallel to each other and spaced according to the same considerations found to apply when stacking yagis. The original "Log-Scan" employs ¾ wave stacking distances (some might prefer a full wavelength). When

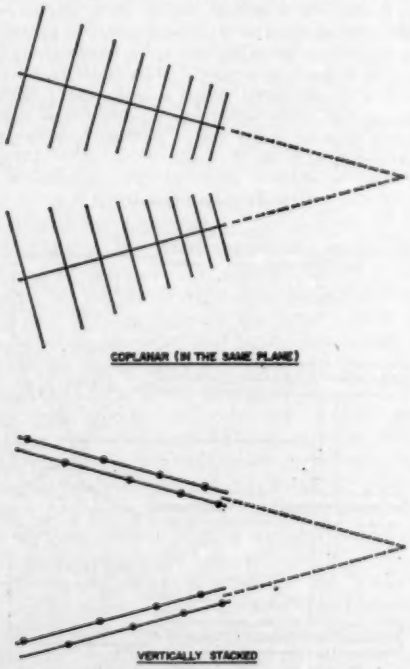
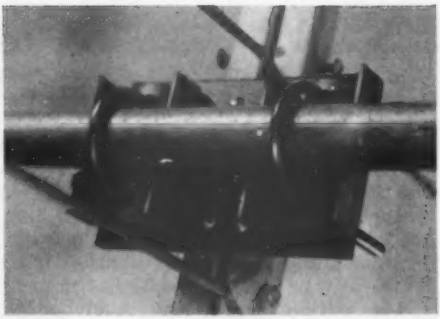


Fig. 5. Method used for stacking log-periodic antennas. Note in the vertically stacked drawing that each set of elements in the antenna are reversed in feed polarity from the opposite set.



Method of mounting the individual "Log Scan 420" log-periodic antennas to the mast. A piece of phenolic is used to insulate the booms from each other and from the mast.

arrays of more than 20% bandwidth are to be stacked, however, they should be tilted toward each other, as shown in **Fig. 5.** This keeps the "active" zones of the stacked antennas at a constant wavelength separation, regardless of the frequency, thus insuring a constant pattern shape. The amount of tilt should be that necessary to bring the (imaginary) apexes together. Up to perhaps six or eight antennas can be stacked by this method, and gains as high as 20 dB are *thought* possible. The angle between stacked sections should be something between two and four times α, which gives approximately ½-wave to a full-wave spacing. It will be necessary to use smaller (2α) angles for larger numbers of elements and larger α angles. When four antennas are to be stacked in a 2 x 2 array, they take on the appearance of a pyramid. Such arrays have been built for UHF TV reception, and, on a larger scale, for satellite tracking.

Be sure, when stacking either L-P's or yagis, that they all have the same side upward. Otherwise, when two are stacked, the phasing is 180 degrees out and a null instead of a peak will occur in the desired direction. With three or more antennas stacked, all sorts of peculiar but undesirable patterns will result if one or two are inadvertently turned over.

L-P's can be made to cover two different frequency ranges if you want to shorten the boom and eliminate a band in the middle. Just leave off the elements shorter than necessary for the lower band, and put the longest highband element where the next low-band element would have been. It is also possible to change the α angle and τ factor in mid-band, so that higher gain can

be obtained at the higher frequencies. Neither trick seems to mess up the SWR curves or patterns in the desired ranges.

Cross-polarized L-P's may be constructed by using a structure of four booms, as shown. The outputs of the two feed cables, if they are kept the same length, can be combined in a hybrid ring to give right- and left-hand circular polarization. Special wideband hybrids have been developed for use with L-P arrays and the like, which work over frequency ranges on the order of 2:1 and more.

Getting it working

After you have designed your antenna and have built the two halves, the best procedure is to temporarily mount them together in some way so you can put the antenna out in the clear and make an SWR test on it. The tests should be made with several spacing values, to see what spacing appears to give the best average SWR. If you are building an array, this only need be done with one section; the results are very repeatable. If you don't have SWR equipment, a good guess at the spacing will most likely give SWR values not more than 50% higher than the best obtainable. This is another advantage of the L-P over the yagi. For amateur TV transmitting work, an SWR of 1.3:1 or less, is desirable to keep from transmitting "ghosts". It is possible to obtain this SWR over 20 MHz, or more, at 432 MHz by adjustment of the boom spacing (see **Fig. 7**).

If the antenna is to be side-mounted on the mast, the SWR curve should be checked unmounted, to set the spacing, and then mounted and rechecked. The mast should be as slim as possible in the case of 420 MHz antennas. The preferable way to mount small L-P's is from the rear. Dielectric masts, rather than metal, might be used more successfully for the side mounting. The final test of the effect of side mounting the antenna, is to confirm that the main pattern lobe is on the axis of the boom. If it is desired to rear mount an L-P, the booms can be extended back about ¼ wave (at the lower cutoff frequency) past the rear element and shorted together on a mounting plate. Side mounting is as much a problem at 420 with yagis as with L-P's, and rear mounting can sometimes help solve pattern problems.

Building the "Log'Scan 420"

If the specifications for this array created interest in building one, the required aluminum from a local jobber will cost about

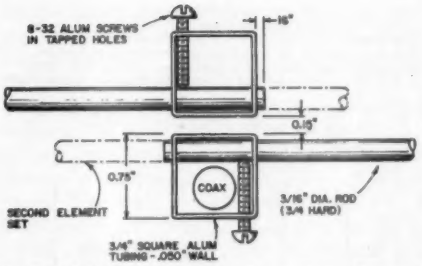


Fig. 6. Method of mounting the antenna elements to the booms used in the "Log Scan 420" log periodic. Clearance for the coax feedline is provided by installing the screws next to the wall of the boom.

$10.00. The boom material is ¾ inch square stock with .050 wall—preferably ¾ hardened. The elements are 3/16 inch rod, ¾ hardened. The elements are made long enough to pass through the boom and protrude about 1/16 inch on the opposite side. Each of the four identical sections requires two 41½ inch long boom pieces and about 13 feet of rod (multiply by four to build the array). The lengths and locations of the elements are given in **Fig. 8**. Note that the elements are not centered on the booms, but are moved toward the other boom as far as possible.

Elements are held in place by aluminum 8-32 machine screws which are threaded through the boom as shown in **Fig. 6**. They should be as close to the wall as possible, to leave room for the RG-8/U feed cable. These screws can put quite a bit of pressure on the elements to insure good contact with the boom; this is important. Since I was worried about corrosion, I rechecked the complete SWR plot after the array had been up some months in the humid, corrosive atmosphere near Cape Kennedy, and found no change.

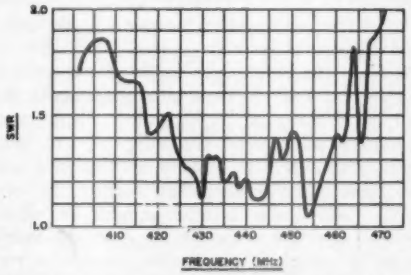


Fig. 7. SWR plot of the four stacked "Log Scan 420" log-periodic antennas. This antenna was designed for use between 410 and 450 MHz; between these points the SWR is less than 1.7:1. In the 420 MHz amateur band, the SWR is less than 1.5:1.

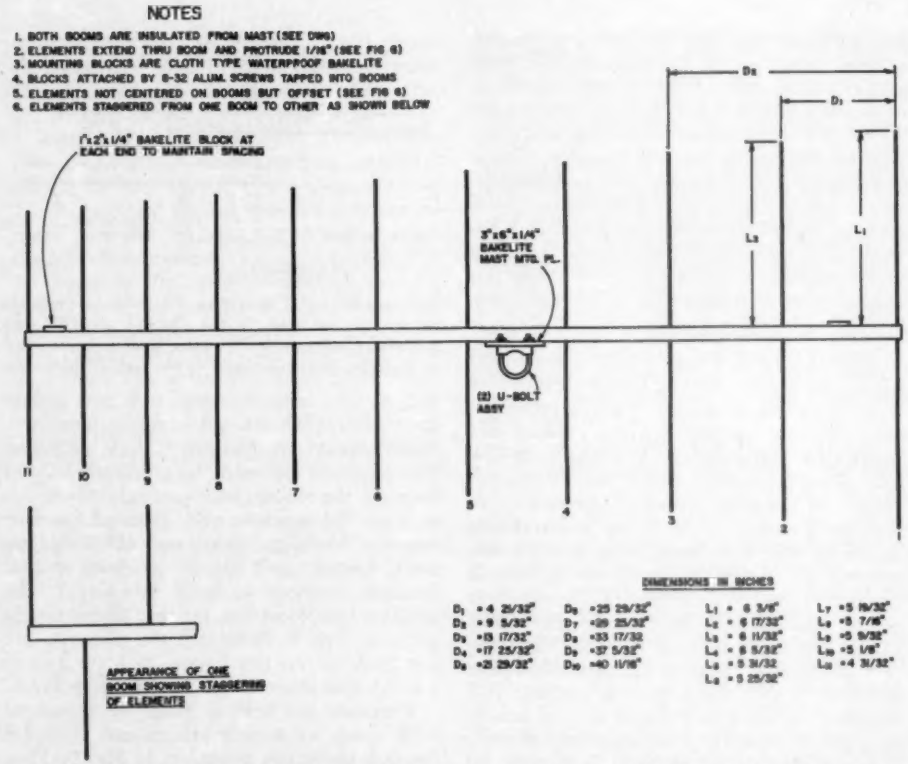


Fig. 8. Top view of a log-periodic antenna exhibiting about 12 dB gain. When four of these antennas are stacked, approximately 17 dB gain is possible. The SWR from 420 to 450 MHz, when fed with 50-ohm coaxial cable, is less than 1.4:1. L1 should be 6¾" long, not 6⅜" as shown.

The ideal antenna would be all welded, and while this might add $30—$60 to the cost of the array, it would virtually last forever.

The mast mounting assembly (four needed), shown in the photograph, is made from a piece of waterproof bakelite, ¼ x 3 x 6 inches, and two TV-type U bolts and clamps. Near each end of the boom pair, an additional piece of bakelite, ¼ x ¾ x 2 inches, is used (on the side opposite the mast mounting) to hold the booms in alignment at the proper spacing of 0.150 inches. Both mast mounting plates and end supports are held on by aluminum machine screws tapped into the boom. Tho lower boom carries the feed cable, and these screws should be offset toward the upper boom to leave as much room as possible. The cable should be run through the boom *before* the elements, set screws, and supports are installed.

The cable attaches to the front of the antenna with lugs, keeping the lead lengths as short as possible. All exposed parts of the cable outside of the jacket, and all of the area around the lugs and attachment screws should be covered with RTV silicon rubber to insure that moisture cannot cause trouble. Tape or other protection should be used on the cable where it leaves the rear boom, to prevent fraying of the cable jacket.

The sections are stacked 21 inches apart, and each cable should extend about 42 inches from the rear of the boom. Match cable lengths and types.

Type N connectors, UG-21/U, should be used on all cables. The cable matching section, which was explained earlier, is shown in **Fig. 4.** Each ¼-wave transformer is 4 inches overall length, leaving about 1 inch of jacket showing between the UG-21/U connectors. Triple-female tee connectors, type UG-28A/U are used for the three tees. The length of conductor inside each tee constitutes part of each ¼ wave transformer, and has been taken into account in the length calculation (which has been verified by

measurement). The 4-inch sections must be made from solid dielectric RG-8/U; foam dielectric would require a shorter length. Recommended antenna feed line for lengths under 60 feet is foam RG-8/U, which has a loss of about 3.9 dB per 100 feet; over 60 feet, RG-17/U or ½-inch foam Heliax, both with a loss of 2.3 dB per 100 feet; and over 100 feet, ⅞ inch Heliax, with a loss of 0.8 dB per 100 feet.

Each section of the array has a 50-ohm impedance, and can be tested for SWR if you wish to verify that all sections are electrically identical. Needless to say, a single section can be used as an antenna with 12 dB gain. The individual SWR curves are fairly similar to the overall array plot in **Fig. 7.** If you wish to obtain the lowest SWR at any one part of the 420 band, it will be necessary to scale the antenna element lengths and location distances slightly, in one direction or the other. I would also recommend one additional set of elements at the low end and two additional sets at the high end, if the antenna must have equally good front-to-back ratio and patterns over the entire band.

The τ factor for the array is 0.97 and the α angle is 2.5 degrees. The design horizontal beamwidth is about 40 degrees, and the vertical beamwidth, about 20 degrees. The low frequency cutoff was designed as 410 MHz; the high cutoff, as 450 MHz.

Actual performance of the "Log-Scan" has indicated it works well. The beam is lined up with the boom axis as it should be, and the horizontal beamwidth is close to 40 degrees. The vertical beamwidth has not yet been measured, but the gain appears to be about right when compared to several yagi antennas. The high and low frequency cutoffs shown in **Fig. 7** are within a few percent of the design cutoffs.

I started building L-P's with the design and construction of a 110-300 MHz single planar log-periodic. Patterns and gain were both good. It has an α of 15 degrees and apparent gain of about 8.5 dB. The second log-periodic I built was a 50-300 MHz planar with two different τ factors, the change to a larger factor being made at 100 MHz. It does a good job on three amateur bands, all of the VHF TV, FM, the 225 MHz telemetry band, and quite a bit more. I am already convinced—try one yourself and be convinced, too.

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Applications for the Dual-Gate FET

Using the 3N126 as a mixer or balanced modulator.

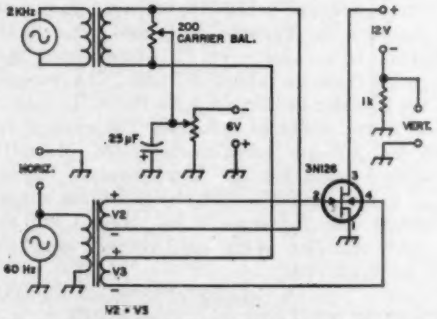

Fig. 1. A 3N126 balanced modulator which was breadboarded to measure performance. In this circuit, a 2 kHz audio signal was used as the "carrier", a 60 Hz signal as the "audio".

The Motorola 3N126 dual-gate FET looks like it might have some interesting possibilities. A bit of bench work showed what it would *not* do, and some of what it *will* do. But then again, maybe not any better than anything else.

The 3N126 is not a product device, at least not in the same sense that the 6L7 and 6BE6 are. It is an FET with two gates—essentially the solid-state equivalent of the old Wunderlich tube which was never very popular. When bias is put on gate 2, the drain-to-source current is reduced, but the transconductance between gate 1 and the drain does not change much until the current is completely cut off.

If a signal is applied to both gates, the device provides just a bit less than twice the transconductance than when using gate 1 alone, and it more closely follows a square-law curve. A 3N126 with zero-bias drain current of 4.5 mA and cutoff of about three volts performed best with both gates biased about one volt negative.

The dual-gate FET can be used as a mixer, with the signal on one high-impedance input and the oscillator on the other. The oscillator swing should be about 6 volts peak-to-peak on gate 2. Under this condition, the gate could be self-biased with a 500k

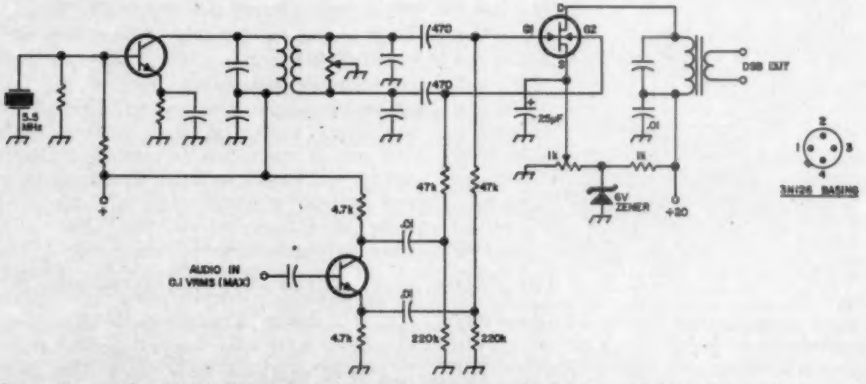

Fig. 2. Proposed 5.5 MHz SSB balanced modulator based on the results with the audio model.

grid leak (*gate leak?*). As a self-oscillating mixer it should be convenient to use and works well to at least 100 MHz.

Another application for the dual-gate FET is in a balanced modulator circuit. To see how the 3N126 would perform as a balanced modulator, I breadboarded the circuit shown in **Fig. 1**, using a 60 Hz "audio" signal and a 2 kHz "carrier". Best operation was obtained with a quiescent current of 0.5 mA, peak current of 0.9 mA, 2.4 volts negative bias, 6 volts peak-to-peak "audio" on gate 2 and 4 volts peak-to-peak "carrier" on gate 1.

With these operating conditions the peak output current is 0.4 mA into a ten- or fifteen-thousand ohm load (assuming a 20 V supply), or a maximum level around −10 dBm. The balance stayed good over a wide range of temperatures. Note that the carrier voltages must be unequal for best balance; in the circuit of **Fig. 1** the audio was applied as equal voltages and there was some audio on the output.

Based on the "model" balanced modulator of **Fig. 1**, the proposed 5.5 MHz SSB balanced modulator in **Fig. 2** using a 3N126 should work quite well.

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Getting to Know Your Receiver

Modern receivers are wonderful! They are full of dials, knobs, switches, and all kinds of goodies. Typically, the amateur goes to the local ham haberdashery, pays his $400 or so, and takes the receiver home with great pride. He then proceeds to plug it in, set the rf gain wide open, the bandpass on 2.5 or so, switch on the AVC and the product detector, and from that day forward the only adjustments are made in the audio gain and the tuning dial.

If this was what the designer/manufacturer had in mind he would have pre-set all these controls and saved a lot of headaches in the manufacture of the receiver. Each of these controls has a purpose. Learning to use them effectively can make your hours on the air a pleasure. Ignoring them can lead to all kinds of discomfort. Let's take a case in point.

Let's say you call a CQ and are answered by a station who has a strong signal. Skip conditions are good, the band is open, and after the usual amenities he tells you he has a new rig on the air and would like you to give him a critical report on his strength, the width of his signal, and suppression of the unwanted sideband. Here is your golden opportunity. You are sitting with the ultimate in receivers and feel confident that you can really show off. You check his S-meter reading . . . great, he is 30 dB over 9. You tune to the sides and discover he is about 10 kHz wide . . . hmm, that's pretty broad. You switch to the other sideband and find his suppression leaves much to be desired. So, since he asked you for a critical report, you are completely honest with him and tell him all these good things about how his signal really isn't too great.

Granted, it is possible that he really does have a bad signal. But, you might very well have ruined his day by giving a faulty report when your receiver was to blame. Let's rephrase that . . . *you* may have been at fault by poor operation of a fine receiver.

Let's recap the report. We won't argue with the S-meter reading, although this is strictly relative. Three receivers, even the same make and model, can easily give three different S-meter readings. Your meter said he was 30 dB over S-9. Any way you look at it, this is a *strong* signal. This kind of signal, especially on 20 meters when conditions are good, can overload the front end of any sensitive receiver. Now, we have to question the 10 kHz report of bandwidth. Was he really 10 kHz wide, or was your rf gain open to such a degree that your receiver couldn't accept this strong signal and reflected a broadness which really didn't exist? Is it possible that by backing down on the rf gain (not enough to disable the S-meter) you would have reached a comfortable listening level, still have come out with the 30 over 9 report, and found he was well within the limits of broadness? It's not only possible, it's even highly probable. But think about the poor guy on the other end. Here you sit with a Pfluggenhoffer 600 receiver, which is considered to be the best on the market, and you give him a bad report. He may accept the fact that he is broad and turn his audio gain down to a degree where he may never make another contact.

Now, how about that report of unwanted sideband suppression? Your AVC was on, wasn't it? One of the functions of the AVC is to make the most of a weak signal. Unless his unwanted sideband is remarkably suppressed, your AVC is going to pick it up and boost it as much as possible to make it readable. Bet you hadn't thought about that. Your AVC doesn't know that this is an unwanted signal. Before trying to give a report on sideband suppression, it is necessary to disable the AVC of your receiver or you are going to give out a false report. The poor ham on the other end is liable to spend days trying to suppress the unwanted sideband, when in reality he was doing fine all along.

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from you and when he is on, you might as well watch TV for all the pleasure you will get from ham radio. Usually this situation leads to animosity (to say the least) and the definite increase in the number of anglo-saxon obscenities which sneak into your vocabulary. I will admit that if he has a schedule on 14.280 with someone who is in the North-East, and you have a schedule on 14.285 with a station in the South-West, you have a problem. Your beams are going to be aimed directly at each other, and there isn't anything you can do except take turns calling and listening until you establish contact and then get as far from each other on the band as you can. However, if you are engaged in just hamming and it makes no difference to whom you talk, you can no doubt get along fine. I've known hams in the same block who managed to work well by efficient use of their receivers. I did it for several years.

This requires tact, diplomacy, and knowing how to use your receiver. You will both have to put your heads together and cooperate, but it can be done. Let's assume he was on the air first and is on 14.280. At best you are going to have to get 25 kHz away from him. So, you move up or down as you choose. Listen to see who he is working. If he is in QSO with a station located to the North-East, turn your beam (I do hope you have one) so that it's null point will cut him out as much as possible. Now, cut your rf gain until he drops out of the picture and rather than calling CQ (where you might be answered by a weak station) look for someone to talk with who has a signal which is strong enough to get through to you; and begin a QSO. Chances are you will block your neighbor's receiver until he realizes what is going on, but then he can take the same measures and continue his QSO in reasonable comfort.

Far too many of the complaints we hear about QRM and splatter are really the fault of the ham's own inability to know his receiver and it's capabilities. Learn what all those knobs and switches do, and if you still leave your receiver wide open for the "Sunday Punch", you have no one to blame but yourself. . . . WØHJL

Betty Entner W6OQY
1901 South Broadway
Santa Maria, California 93454

The Silent Shepherd

"For heaven's sake, you're not going out there now, are you?! Why, it's the middle of the night!" Martha's sharp voice knifed through the dark bedroom. Al pulled on his bathrobe and reached for his slippers. He braced himself for the onslaught he knew was coming.

"Don't you get enough on weekends?? Do you have to listen to that gibberish all night, too?"

Al paused in the doorway. He spoke soothingly, as though to a petulant child. "I know it's late, but I'm restless. I'll listen around the bands a while . . . it'll relax me and it won't bother you . . . I'll keep the door closed. Go to sleep now, honey. I'll be back soon".

Martha jerked the bed covers up around her ears and turned her head to the wall.

Pensive, Al headed for the garage where his equipment waited like a buried treasure . . . a source of comfort and satisfaction . . . even a refuge sometimes. He longed for Martha's acceptance of his hobby; not necessarily her partaking of it, but at least a tacit approval. "Although, maybe I do spend a lot of time out here", he admitted ruefully. A deep sigh escaped him. "Well, I'll make it a short session tonight; no use aggravating her any more than necessary."

He threw the master switch by the door, and felt a surge of pride as the powerful gear sprang to life. He loved these squat boxes, warm and alive with promise. He thrilled anew when he heard them purr with contentment as power coursed through their wire veins. He followed anxiously their every heartbeat, revealed by the swinging needles in their opaque windows; and he basked under the bright gaze of the tiny green and red eyes on their flat faces. Stationed on the roof, the multi-fingered antenna clawed at the sky, gathering in radio waves like a giant hand sweeping crumbs from a table.

He settled himself at the glass-topped desk, slipped the headphones down over his ears and spun the vernier dial on the receiver. Signals were thinly scattered between static crashes.

"Damn", he thought. "Just when I feel like ragchewing, either the skip is wrong, the band is out, or nobody is up". He spun the knob the other way, and heard the flash of a faint voice; oriental music wavering through from the Pacific area; and the regular pulsing of the electric blanket in the house. "Have to make a filter to eliminate that", he reminded himself.

Suddenly he stiffened. What was it he had sliced across? MAYDAY! Good Lord, was it? MAYDAY?

Swiftly, every nerve alerted, he backtracked. He pulled the needle cautiously along the dial, delicately probing for his quarry. Had he imagined it? Could he find it again? "Keep calling", he urged silently. "Don't give up! I'll find you, only don't stop calling!"

There it was again! Mayday! Delicately he rocked the knob across the spot until it was dead-centered. Then he zeroed his VFO on

it, and crossed his fingers for luck. The voice vanished. The static had engulfed it like a turbulent wave sweeping over a bit of seaweed.

He threw on the transmitter switch, grabbed up the mike and began calling.

"Q R Zed the station calling Mayday. Q R Zed? This W6JFD, Vallejo. Over".

As he waited, he licked his lips and tasted salt. Then it came, haltingly.

"W6JFD . . . . K6VLE Mobile . . . . How copy?"

"Not solid, but think I can pull you through. What's your problem? Break".

"Hurt . . . . been trying hours . . . . raise somebody . . . ." Labored breathing punctuated the rambling answer. ". . . my car and when . . . . when . . . . woke up . . . . down here . . . canyon . . . . legs pinned under boulder . . . and door frame . . . can't pull free . . . . real mess . . . . help me?"

Al detected growing panic in the voice.

"What's your exact location? Break".

"Don't know . . . never here before . . ."

Despair spanned the gap and crept into Al, too. He must learn more, and fast. The man thought he was four or five miles from the junction. Which junction? Laguna Road and Highway 80. Near what city? East of San Diego. As he faltered, Al patiently prodded him on.

His headlights were smashed, he said. Flashlight? Yes, but couldn't reach it. No, the horn hadn't worked for months. Landmarks? He seemed to remember crossing a bridge just before . . . . .

Finally the delays between his words lengthened ominously, and he moaned, "Can't think more . . . pain's bad . . ."

Al forced himself to speak casually, "Hold on. I'll cut out here, and send some blind calls. See if I can raise somebody closer to you. Six hundred miles is a long haul; maybe we can trim the odds. Stand by".

With deftness and speed, Al set to work, calling and listening. Calling and listening. Finally he conceded defeat.

"Sorry, buddy. No luck there. How're you feeling now? Over".

There was no reply. The distant transmitter, however, appeared to be operative. Its electronic stream buoyed the needle on Al's meter, marking the place on that turbulent sea of sound where the voice had died.

Now the odds had shifted. Rescue could be seriously delayed. The ugly threat of gangrene insinuated itself into his mind. He recalled isolated battlefields and fallen men; bloodless limbs and lurking rot. Apprehension spurred his thinking as he conceived intricate solutions that dissolved under the pressure of practicality.

He fumbled absently for a cigarette. Then he knew. Rapidly he dialed Highway Patrol headquarters and outlined his plan to the police dispatcher.

Now he could do nothing more, but was reluctant to leave his post. Maybe he would come to know if the man was found. With sightless eyes probing a dark canyon, maybe he could somehow know.

He remained at the dimly lit operating desk, head lowered, slowly doodling along the margins of the logbook. Outside in the sleeping streets, a dog howled its loneliness.

He did not know how long he had sat there, when the receiver abruptly sprang to life. His head snapped up as a voice cried, "Here he is! Over here! Let's have those lights over this way more!"

Loud shouts and crashes displaced the stillness he had been monitoring.

"Easy there . . . . easy . . . . lift him up easy".

Al was jubilant. He sat transfixed as he visualized the scene performed by actors unaware of their audience. Finally the din abated, then faded completely as evidently the men bore their burden up the canyon wall.

Al pushed back his chair, and, with hands clasped behind his head, arched backwards in a tingling stretch. Yawning widely, he rose and leaned forward to switch off the receiver. He paused midway. Two stragglers, apparently, spoke.

"You can chalk this one up to you public utility boys! Those portable field strength meters sure came in handy".

"Yeah. Lucky this guy's transmitter gave us a steady note to home in on; what's rough is trying to trace some erratic appliance that's tearing up all the TV sets in the neighborhood!"

"What I can't figure is who sucked you guys in on this deal in the first place?"

"Well, all I know's the Patrol rousted me outa bed and says get all my gear together . . . and something about some amateur radio operator around San Francisco hearing this guy's call for help, and . . . ."

"Jeez, you mean some guy six hundred

miles away . . . . ?"

The disbelief in the question made Al laugh aloud, while the voices slowly dimmed and finally merged into the ether from whence they had sprung.

This was one time, he reflected, where a mobile rig really paid off . . . . wonder what kind it was . . . . it put out a pretty good signal. Maybe someday he would have one—Martha might even get a kick out of it, especially on long trips.

His reverie was shattered by the metallic jangle of the telephone.

An amiable police reporter requested more details of the incident. How long had Al had this hobby? Did he know the other man involved tonight? Would he mind if the local papers ran the story? Al hesitated. He hadn't anticipated publicity. In the end, he capitulated, with one reservation: "Remember, now, none of this 'big hero' stuff!"

Clearing the desk top, he looked forward to getting back to Martha so she could share his elation.

She woke on his arrival, and struggled up onto one elbow.

"It's about time you got to bed! Staying up 'til all hours with that silly radio stuff. Honestly, sometimes I swear I just don't understand you!"

He knew a sudden tiredness. Mutely the golden moment fled.

He lowered his head to the pillow and closed his eyes. Tonight his life had been briefly entwined with that of a stranger, and the union had borne sweet fruit. This would always be his secret glory. Pleasure warmed him.

Gently, he said, "Go back to sleep, Martha".

. . . W6OQY

Your Station Log — A Legal Document

A radio newcomer asked the other day, "What evidence do I have that I'm bonafide when my license is at the FCC for modification or renewal? I understand a photostat is not acceptable evidence for operating another station in the absence of the original license." The answer lies in that most important record, your station log.

Whenever your license leaves your possession for any reason, a written statement concerning its whereabouts should be placed in your log. This notation should include the date and where it was sent as well as its current expiration date. Should the Radio Inspector visit your station, this is valid evidence to him (since your log states it is accurate to your best ability unless proven otherwise) that you hold a valid license. This log item offers you additional protection as well. If your license was sent to the FCC prior to its expiration date, you can continue amateur operation after its expiration pending the return of the new document from the FCC. These few words in your log offer you a world of protection.

Similar to a ship's log, also a federal requirement, your station log is a chronological record of the station activity. At a government hearing or court action, a subpoena can be issued for its appearance as evidence (people's exhibit) in the case on the part of the prosecution. Unless proven in error, your log is accepted as legal evidence that you were on the air at the time stated and in contact with a particular station for a specific period of time on a certain frequency band and mode. This is not testimony; it's written in black and white on paper and very convincing to any jury.

Don't overlook the fact that your log can contain other personal information concerning your station for future reference. Such information can take many forms:

1. When you put up that new beam; its SWR, etc.
2. When and what tubes (or transistors, or other components) you placed in the rig.
3. A record of QSL's received-sent, WAS or DXCC.
4. Notes regarding skeds, nets, originated message numbers, etc.
5. If mobile, where you were; rig maintenance and last tune-up.
6. Many more.

Yes, your station log is a most important legal document and deserves your careful consideration at all times. Keep it right up to the minute to the best of your ability.

. . . George W. Tracy, W2EFU

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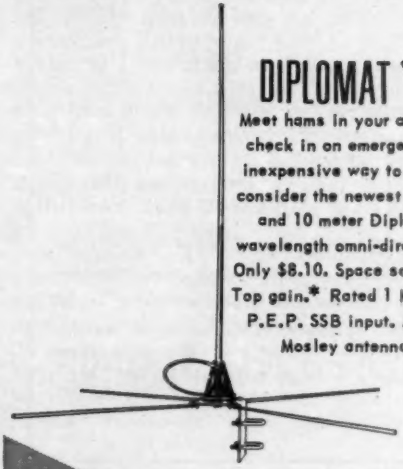

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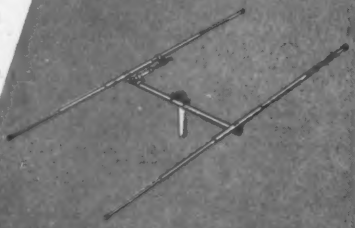

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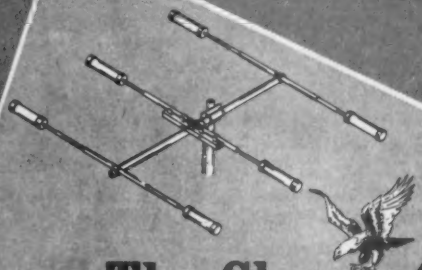

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Torticollis and all that Jazz

Being a YL can be frustrating, and at times, a pain in the neck.

If you look for "torticollis" in a dictionary, you will see that it is defined as, "An affliction causing twisting of the neck and an unnatural position of the head". Translate that verbiose passage into everyday English, and you'll find that it means, "a pain in the neck".

I've been a ham for over a year, now. I graduated from Novice to General; I went from a simple novice rig to an advanced (?) general one, and I have perforated the wall of my ham shack with tiny thumbtack-sized holes—guess what they're for. But in all my time as a ham, I don't think that I have given many torticollis, and I haven't suffered from that affliction to any great extent (other than the pains caused by fruitlessly calling CQ for hours at length). In fact, every moment of my ham career has been a sheer delight.

That statement isn't quite truthful, though. While I've undergone no great trials and tribulations during this time (other than the loss of nails on the way to the FCC office), I've had a few experiences that no OM has ever had.

When I first got my ticket in August of 1965, we were living in an apartment. I did not have a transmitter, and the owners of the building were very unfriendly to my cause. As I sat by my faithful SX110, staring at that piece of paper that declared to one and all that I was WN6QOT, I vowed that I would get on the air just the same.

I did—two months later.

After we moved into a house, plans were made concerning my on-the-air debut. A friendly local ham, from whom I purchased my rig, and who helped me immeasurably in the months to come, aided me in erecting a skyhook. It was an inverted vee for forty meters, on a ten-foot pole on our roof. That antenna is still up there, but now it shares the pole with two other inverted vees—one for 20 and one for 15 meters.

To get back to the narrative . . . finally, all was in place. I listened around, called a few CQ's, but did not get any replies. Then I heard a station calling CQ on my crystal frequency. I threw the knife switch to transmit, called him, and he came back. His call was WN6PVF, his name was Don, and it was the most exciting QSO I ever made.

The next day, I arose bright and early to try to work a few stations. I tried a call. No reply. Another call. Ditto. Five hours and fifty tries later, I happened to look very closely at the knife switch, and found that a lead had been loose.

Technical boo-boos, though, are common. Almost everybody has them. But the things which cause the most torticollis are of a different nature. *Are they different!*

As a novice, working only CW, I was called "OM" at every turn. A typical opener on the part of the other party would be "GE OM." Some of the more persistent chaps punctuated almost every statement with an "OM". "UR RST 579 OM" "QTH PODUNK OM BT NAME CHUCK OM SO HW CPY OM?" etc. Majority rules, but when you're

in the minority, this thing gets pretty wearing.

For the first few times, I just gritted my teeth, waiting to say, "NAME HR IS CHERYL CHERYL ES IM A YL YL YL." I wondered if any of those who insisted upon the use of OM and found out that the "OM" with whom they were conversing was a YL ever felt the least bit chagrined.

Speaking of YLs and OMs, I was in QSO with a WN6 whose name was Pat. Having a particularly acute case of foot-in-mouth disease that day, I remarked brightly, "It's so nice to meet another YL on the air." I chattered gaily on about how there were so few of us, and I inquired of my erstwhile friend when she had received her ticket and how she had become interested in hamming. I turned it back, received hasty 73s and an SK. After this, I looked that WN6 up in the Callbook. Woe unto me when I discovered that *his* name was Patrick!

All this time, I had been studying feverishly for my general. My parents and friends wondered where I disappeared to every night, carrying those thick books. Closeting myself in the shack with the *Radio Amateur's Handbook*, I pondered the difference between a Class AB1 and a Class AB2 amplifier. W1AW was my best friend during this period, as it whispered sweet dahdahdidah dididit dahs in my ear.

At last, the test-taking time came. I was fairly sure that I would pass the code, but I wasn't certain at all about the theory. I walked into the office, filled out the forms, paid the four dollars. Then the announcement came that the code test was to start. Pencil in hand, I waited. Say, this wasn't too bad! Then I found out that I had passed. Next came the sending—passed again! Now the biggest hurdle was approaching—the theory. Old trepidation in person, that was me! I managed to pass, though, and I practically danced all the way home!

Now the long wait for the ticket to arrive. Time for rig-looking, along with some ham friends. With their aid, I managed to buy a used HT37 in mint condition, and the wait went on.

The ticket finally came on January 29, 1966. *Now* I could see what phone operation was like! At least, no one would think that I was an OM using that mode.

That's what *I* thought.

I happen to have an alto voice, which means that, on sideband, some do not know to which sex I belong. This presented problems, to say the least. For instance, there was that QSO with a W6. "Good evening, old man. (I felt safe in saying that, since I could tell by his voice.) You're Q5, S8 here in Panorama City, about eighteen miles north of LA. Name here is Cheryl, C-H-E-R-Y-L. So how copy?" I felt sure that my name and voice indicated that I was a YL.

Back he came. "Good evening, Cheryl. You're Q5, S7 here in such and such. Name here is (I can't remember it now, but for the sake of argument, let's say it is) Fred." A pause. "So back to you, and, uh, by the way, are you a boy or a girl?"

Well, I informed him of my gender. When he came back, he said, "I wasn't sure because there are quite a few boys whose voices are changing, and I couldn't quite tell what you were."

That's true, but . . . A *boy* named *Cheryl*?

What next? Well, as time went on, this episode was repeated quite a few times on phone, and as for CW . . . you are male until proven female. I was, and am, therefore, in the habit of saying, "Name is Cheryl, Cheryl, and I am a YL YL." Even so, a few fellows ask me to repeat my name. I guess they can't believe their ears.

I was advancing in my ham career. Now on 40, 15, and 20, and with a Drake 2B (I had traded in my trusty SX110 and a fifty dollar gift certificate won at a local hamfest), I was busy ragchewing, trying to DX, and dipping into construction.

About DX . . . considering the antennas, I have not done too badly. 17 countries and 44 states worked—not a record, but I've had a lot of fun doing it.

Remind me to think of that while in the process of trying to make myself heard in a pileup of kilowatts on 20 SSB!

Seriously, though, my first love in hamming is ragchewing, and it's all the more interesting when it is with someone out of the immediate area, though I enjoy yakking with the locals, too. I despise rubberstamp QSOs, but, contrary to the theories of a few hams whose articles I've read, most hams are not tongue-tied idiots with nothing to say beyound, "RST . . . QTH . . . NAME . . . RIG . . . WX . . . 73 ES CUL . . . SK". Most hams—most people, for that matter—are interesting to talk to, and have a lot to say.

To get back to the subject of QSOs, I have been a great disappointment to many. I'm

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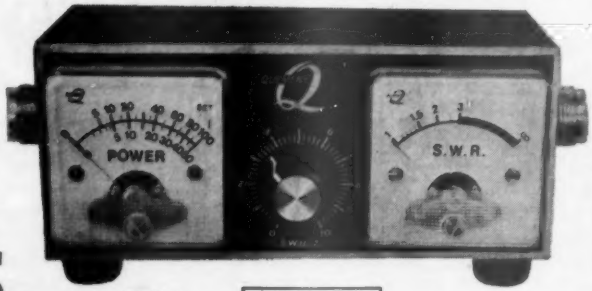

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speaking of those fellows, stationed on some lonely island, who haven't seen a girl or even heard a feminine voice for months. Take, for example, a certain KL7 who worked me once. We were talking and he mentioned the fact that he was on a solitary island. He then asked how old I was. "How old do you think I am?" I shot back. "About sixteen or seventeen," was his reply. This was flattering, and maybe I should have let him think that, but I decided to tell him the truth. Imagine the look on the poor fellow's face when he found out that the YL he was talking to was only thirteen years old!

That reminds me of another incident which took place shortly after I first got my general. I contacted a WA7 who was maritime mobile at the time. He mentioned that he was about six hundred miles off the coast of California, and that he would be docking in a few days at Los Angeles. He said that he might pop down and visit me. I thought he was joking, but I hadn't told him my age, either.

About four days later, there came a knock at our front door. My father got up to answer it. I was standing in the hallway, so I clearly heard the conversation that ensued.

"Yes?" said my father.

"I'm Don, WA7XXX, maritime mobile. Is Cheryl here?"

"Just a minute." Daddy walked down the hall. Finally, drawing near, he said, "There's a boy here who says . . . "

"I know; I heard."

In the meantime, my mother had invited him in. Here he was now, walking toward the shack. "Cheryl?" he inquired questioningly. I nodded, and he walked into the ham shack in silence.

I didn't have to imagine the look of shocked surprise on that young man's face—I saw it!

Hamming hasn't held too many other little incidents recently. Going to the local radio clubs, checking the rigs over, replacing a few tubes and fuses, working my first European, a UA—quite a feat for me! Learning more about electronics, trying to build a few things, and just enjoying the hobby in general.

Learning about the technical aspect of hamming has interest for me too. I think I'll try some RTTY, and who knows, maybe even ATV.

Maybe then they'll know *what* I am! ■

Steve Katz WB2WIK
86 Redwood Road
Springfield, New Jersey

An All-Band Rotatable Dipole

Want an antenna with 8 to 10 dB gain, small dimensions, all band operation, low angle radiation, low SWR, and a low price? No such animal.

But, if you'll settle for one with little or no gain, (but a good front-to-side ratio), comparatively small dimensions, a fair radiation angle for DX work, a good SWR, (below 2:1), and a *very* low price, this is it.

I feel that no real explanation is necessary. It is simply a dipole for 40-10 meter work; on 80 it can be loaded with a little experimentation. Get this antenna up 50' off the ground on a rotator, and you've got it made.

The coils, L_A and L_B, are B&W #3022 miniductors, which you should be able to grab for $1.25 or so apiece; insulators are Johnson type 65, selling for about 30-35 cents apiece. The two 16' elements are ½" diameter electrical thin-wall tubing, either aluminum or steel conduit. The wooden support is a 2 x 2, about 6 feet long (paint it); the mast is a TV mast, preferably leading to a rotor at the bottom.

Mount all of this as shown in Fig. 1 and that's it. The antenna should be fed with 52 or 75 ohm coax and the coils tapped for the lowest SWR on the preferred band. If you tap them for 40 (usually about 10 turns onto the coil from the element) the antenna works fine on 40 and 15, and sometimes even 80. Tap for 20 (low end of the band, about 1 turn of coil; high part of band, bypass the coil completely) and it works well from 20 through 10. For 10 meter operation, the lowest SWR will occur when there is no inductance at the antenna (bypass the coil).

You can check the SWR while the antenna is still on the ground if you like, as very little, including transmission line length, will effect it to any great extent after it is raised. The SWR on all bands will be better than 2:1 at resonance, and SWR's of 1.1:1 at resonance are not unusual. The SWR will not go above 2.5:1 anywhere in any band if the antenna is built and installed correctly. An antenna tuner will provide nearly instant bandswitching without touching any taps and a pi-net in the transmitter will also help.

Incidentally, this antenna works quite well on 80 and 75 if you experiment with the tapping on the inductor, which for these bands, will be near the bottom of the coil (from the element) for maximum inductance.

The whole system costs less than $10.00, not including a rotator, but it really performs.

. . . WB2WIK

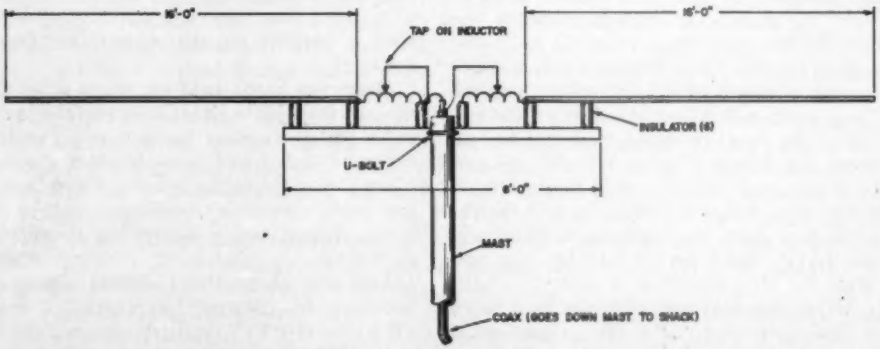

Fig. 1. Construction of the all band rotatable dipole for 80 through 10 meters. When properly adjusted this antenna provides excellent results without a large cash outlay.

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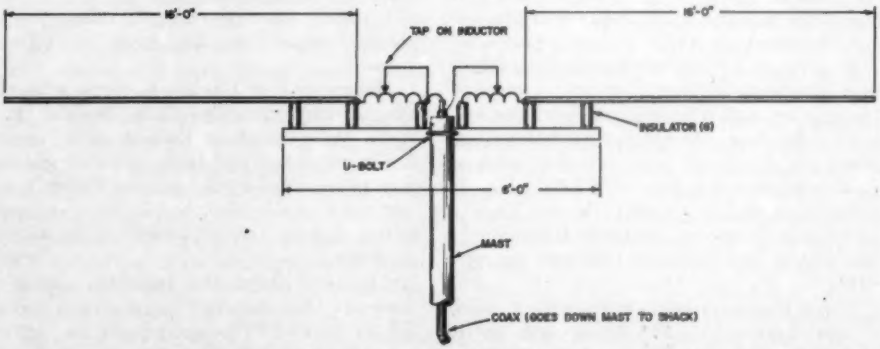

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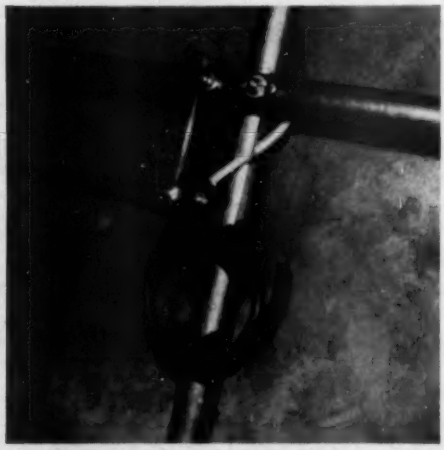
A Cheap and Easy Gamma Match Capacitor

Here is a system which can handle a kilowatt and eliminates the mechanical problems in building a gamma match.

The yagi antenna fed with a coaxial feedline is the most widely used antenna on the HF and VHF bands. It is mechanically simple and quite strong. But the driven element of a yagi has a very low input impedance (on the order of 15 ohms) and presents a problem when matching the driven element to a coaxial feed-line. Many antennas use the familiar gamma match to raise the input impedance to a value compatible with the coaxial feedline.

Most gamma matches use an air variable capacitor to tune out the reactance introduced by the gamma rod. This introduces both mounting and weatherproofing complications. Often the gamma matching system is more difficult to construct than the rest of the yagi. Fixed capacitors, such as mica transmitting capacitors, have been tried as a means to eliminate the need for a weatherproof enclosure, but the added inconvenience of tuning the antenna with an air variable capacitor, then substituting a fixed capacitor of the approximate value, has proven to be more trouble than it is worth.



The cheap and easy gamma capacitor mounted on a yagi antenna. Plexiglass sheet is used to support the end of the gamma rod.

While searching for a simpler method, coax cable itself was tried as a substitute. It has a capacitance of from 20 pF to 30 pF per foot depending on the type used. It can be trimmed to the proper value needed, needs no difficult mounting assembly, is just as weatherproof as the feedline itself, and is considerably cheaper than an air variable.

The photograph and Fig. 1 show the mechanical details of the capacitor. The details of the gamma rod are up to the reader. The first step is to determine the approximate capacitance needed for a gamma system on the design frequency of the antenna. The following table shows approximate guide values for a standard three or four element yagi.

20 meters	100 pF
15 meters	75 pF
10 meters	50 pF
6 meters	30 pF

Then determine the capacitance per foot of the coax cable to be used for the feedline.

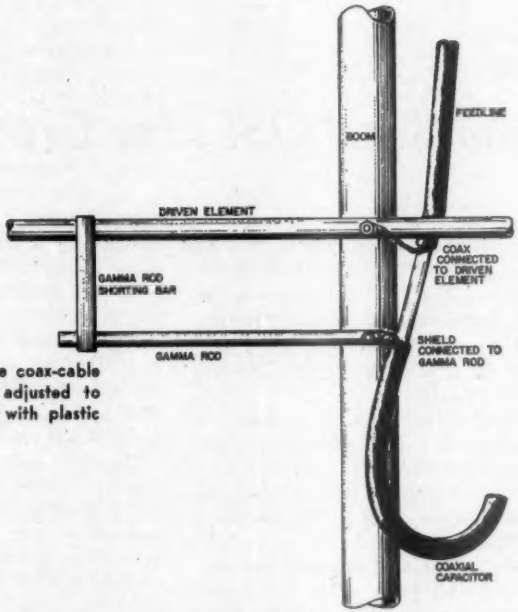


Fig. 1. Mechanical layout of the coax-cable gamma capacitor. After it is adjusted to the proper length, it is sealed with plastic tape.

RG- 8/U	29.5 pF per foot
RG-11/U	20.5 pF per foot
RG-58/U	28.5 pF per foot
RG-59/U	21.5 pF per foot

From this, the length of coax needed to provide the desired capacitance can be determined. For instance, a ten meter beam would require about twenty inches of RG-8/U for the gamma capacitor. Measure back this distance from the end of the cable and remove three or four inches of the outer vinyl cover. The braided shield should then be cut in the middle of the area from which the cover was removed, making sure not to cut the dielectric between the shield and the inner conductor. The two lengths of shield should be unbraided and twisted to form two leads.

The shield lead from the transmitter end of the coax should be connected to the center of the driven element in the normal manner. The shield lead from the short section used as the gamma capacitor is connected to the end of the gamma matching rod. No connection is made to the center conductor of the coax.

The gamma rod shorting bar is adjusted for lowest SWR at the operating frequency, and then the free end of the coax is trimmed about an inch, and the gamma rod shorting bar is adjusted again. This procedure of alternatively adjusting the shorting bar and trimming the coax is continued until the SWR is reduced to 1:1 at the operating frequency.

After the matching adjustments have been completed, the free end of the coax and the area from which the outer jacket and shield have been removed are sealed with a good grade of plastic tape to keep out moisture. The free end of the coax is then coiled up and taped to the boom of the yagi, presenting a neat and simple appearance.

This system has proven to be easy to construct, rugged, and quite effective.

. . . KØUTX

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Personalized QSLs for Greater Returns

Many and devious are the methods used by many U. S. DXers to coax that elusive QSL from a rare foreign station. Some of the big wheels have such esoteric techniques for obtaining rare cards, that they would just as soon give you the towers off their shacks as divulge their secrets.

What follows is by no means an expose of anyone's private life, but rather some ideas on how to make the rare DX operator notice your QSL from among the multitude so he'll be motivated to send *you* a card ahead of the competition.

A typical situation is something like this. After calling for six hours or so, you finally work PB41CU in Lower Kumupistan, which is on the Carbuncle River about three inches farther than the map goes. A real rare one. Well, your biggest headache is that Simple Q. Sideband, across town, worked him too. And if you don't get your confirmation before Simple Q. gets his, ole S. will beat you to the draw (more about that later), and his batch of confirmations will capture that first WTW certificate before you even get off the ground. S. Q. keeps bragging at the DX club meetings about how he's always receiving his QSL's from the rare ones "Via air mail within at least two weeks."

How does he really do it? Dear old buddy, you know that S.Q.S. is not about to tell *you* or anybody else how he does it. He usually says something like, "Shucks. Just sent him my card and some IRCs, that's all. Really very simple!" (That's why they call him Simple.) Well, that *ain't all*, dear buddy. What you don't know is that Simple Q. Sideband didn't send any ordinary mass-produced QSL. He sent something that reflects his individuality; something that really expresses his appreciation for the DX QSO.

The author has found, from some twenty-five years of DXing experience, that the personal touch is the best way to impress the foreign amateur, and impress him you must, if you want to be recognized.

Look at it from the rare DX operator's point of view. To him you're just one more U.S. station. He receives *thousands* of U.S. cards. One more run-of-the-mill card doesn't turn him on one bit. But if he receives a card that's unique (accompanied by IRCs or return postage, of course) the chances are that he'll be impressed and just might reply sooner than via the usual routes, if at all.

The idea is something like courtship. Once you've snagged that rare one, your dance is just beginning. You've got to make him want to reply to your card. If your QSL has some appealing feature, it shows that you think enough of the foreign operator to send him something special as your thanks for a new country.

Some overzealous types have been known to send the foreign ham a ten-dollar bill, a crying towel, a pound of cheese crackers (broken on arrival), plus heaven knows what—all in an attempt to make a big splash. All this may help, but there's an easier and less expensive way to increase your QSL returns *and* your prestige at the same time. It's the personalized QSL card. Hand made.

You say you're not an artist? Not important. The method to be described requires little in the way of artistic ability. All you need is some imagination, a little time, and five or six dollars worth of material.

The examples shown are just a couple of the many ideas that have been used. Blank card stock was purchased from a local print shop. (Three hundred blanks cost $1.85.) The data block (date, time, etc.) was, in this case, typewritten with an IBM Executive typewriter. It is realized that most hams don't have access to such a machine. The next best thing is to have the blanks preprinted with the data block, name, address, etc. This is no more expensive than a regular run of one-color QSL's, and you won't need very many. Or, if you can hand letter the data, so much the better. The hand-applied call letters and decorations are what distinguish the card, and the variety and styles

are only limited by your imagination.

The call letters and decorations are applied to the blanks using what is known as a graphic aid transfer sheet. These are obtainable at most stores handling commercial art supplies. Many different brands are available. A 9 by 12-inch sheet costs about $1.50 and, depending upon the designs and characters chosen, contains enough material to make about a dozen QSLs for those special contacts.

Be sure, however, that you obtain transfer sheets. Another type of graphic aid sheet is available that requires the design to be cut out, carefully positioned, and burnished down onto the card. This is laborious and time-consuming, and a faint outline remaining around the design makes it look "pasted on."

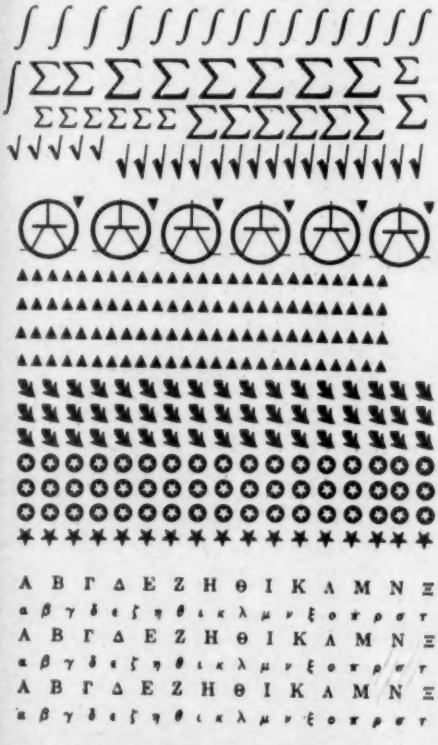

Fig. 1. Transfer sheet used to develop the personalized QSL cards shown in Fig. 2 and 3.

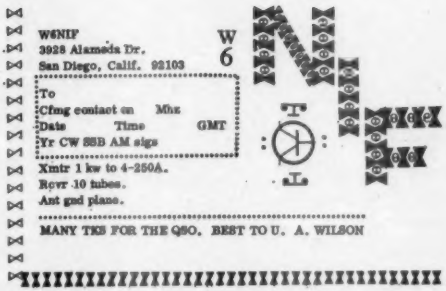

Fig. 2. Personalized QSL card using rows of triangles and the Greek letter theta from two sheets of mathematical symbols.

The transfer sheet comes in several colors and contains just about every geometric design, symbol, letter, number, and pattern imaginable. Best of all, it gives your card a professional appearance, and the receiver of the card will wonder how you did it when you tell him it's hand made. Fig. 1 is an example of some of the patterns.

The transfer sheet is transparent, so that characters can be easily applied by eyeball measurement. Once the design is positioned over the card, it is rubbed lightly with a dullish pencil. The design will then transfer onto the card. If you don't particularly like the results, the transferred material can be easily removed by scraping lightly with a razor blade or Exacto knife. Another design will readily transfer onto the corrected spot. When the card is finished, a light spray of fixative (Krylon is good) will make the artwork stick to the card like a bum to a ham sandwich.

In the example of Fig. 2, the call letters and border were made by using rows of triangles and the Greek letter theta from two sheets of mathematical symbols. Fig. 3 is another design using a combination of electronic symbols, Greek letters, parts of Arabic letters, and math symbols. The call letters are made from integral symbols. The cartoon was made by positioning other math symbols on the blank card in various ways. For example, the hair consists of braces; the nose is an upside-down Greek omega; the jaw line is part of a parenthesis. A little experimentation will reveal talents that you never realized you had.

This method of making cards is, admittedly, not a volume process. However, it is one

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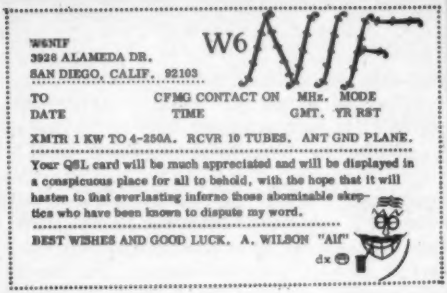
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Your QSL card will be much appreciated and will be displayed in a conspicuous place for all to behold, with the hope that it will hasten to that everlasting inferno those abominable skeptics who have been known to dispute my word.
BEST WISHES AND GOOD LUCK. A. WILSON "Al"
dx

Fig. 3. A QSL design using a combination of electronic symbols, Greek letters, parts of Arabic letters and math symbols. The face is also made from transfer symbols: the hair consists of braces, the nose is an upside-down Greek omega, the jaw line part of a parenthesis.

way of expressing your individuality to that rare foreign ham, and it's a pleasant way of killing time while waiting for band conditions to improve. The hard work is already done for you on the transfer sheet. All that remains is to create your own design, no two of which will be exactly identical. You will then have a card that is quite distinctive. If you come up with a design you especially like, an offset print shop will run off as many copies as you want—on your own card stock, if you wish. Each color, however, requires a separate run through the press, and the cost will increase proportionately. However, you will have lost the basic impact you're trying to create: uniqueness will be replaced by just another printed QSL.

It's certainly true that five or six dollars will buy a lot of production-type QSLs. These range from the mundane to the bizarre. Some have three-dimensional letters, fluorescent inks, gold dust, hog bristles—you name it. The author has no axe to grind with the QSL printers. Their products are fine for those who like them. But remember, if you have Print Shop Special Card No. 10 with embossed beer cans in six colors, a thousand other guys do also, and it really doesn't impress the rare DX operator at all.

Much response has been received from foreign amateurs on the author's personalized cards. The QSLs received-to-sent ratio has increased at least 70 percent since they have been used. Most of the comments have expressed approval of what seems to be the exception in ham radio these days: making it yourself.

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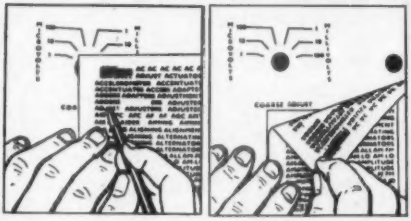

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Howard Pyle W7OE
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Pioneer DX

Working DX in the 1930's was a little different than it is now.

Back in the May issue of 73 (DXpeditions—page 111), our old buddy Wayne (never say die!) expressed a bit of speculation about what DXing was like some 30 or so years ago . . . did it present the problems the DX'ers face today? Somehow that statement electrified the nostalgic nerve in this ol' body; I decided to let him have it. Maybe some of you other 'young oldsters' will also find a bit of entertainment in sharing this little excursion into the 'forgotten' days with Wayne and me.

Let's see now . . . thirty years ago; that takes us back to the late thirties. Not so very ancient as far as the *real* pioneering days of ham radio, but just the same, there's been a lot of changes in the span of the last three decades. Maybe DXpeditions would be a good place to start; in 1937-38 what *was* a DXpedition? No one then had the least idea of equipping a sloop, yacht, sampan or what have you to sail the bounding main in search of way out places where hams were still only something which came with a hog! Now, thirty years later . . . wow! A more controversial subject in the DX world would be hard to imagine; look at the battle royal going on in efforts to take Don Miller through Hell and high water! Like any other controversy there are the camps of the 'fers' and those of the 'agins'. No Wayne, those kind of run-arounds were unheard of in the good ol' days.

DX was then something which was a thrilling happenstance in most cases. Organized, concerted efforts to work the 'most of the many the farthest away' might have been a dream in the minds of a few hams with a crystal ball but such never left the seance table . . . not right then. You simply put out a 'CQ' slowly and carefully and maybe stretched it out a bit. Then you flipped a switch or two, held your breath and *hoped* some guy a few thousands miles away and preferably with a zaggy prefix, would take the bait. If you were lucky and did hook up with such, there was no one 'looking down your neck' on the air, nor standing on each others' shoulders to get a whack at your prize the minute you finished. Today? I don't have to tell you; you hear it for yourself. Just sign off with a ZL, VK, JA,

This little Reinartz tuner, built by the author in 1922, served him well into the early 1930's.

This QSL card from Moscow in 1931 still stands as the author's record DX! 40 watts input on 40 meters brought it. The prefix for U.S. calls for a short time then was "NU", hence, the author's call appears as NU7ASL.

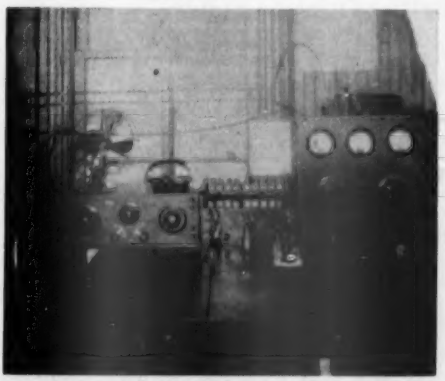
G, DJ . . . any of 'em, and all Hell breaks loose! Transistor pip-squeaks through kilowatts plus (?) get in there with both feet. A good simile is the aggregate rolling around in the drum of one of those mobile ready-mix concrete trucks! Worse yet, a lot of guys even try to beat the other 'highwayman of the air lanes' by jumping in to call your man even before you complete your sign-off! In 1937-38, when you finished such a contact, you were more likely to call a pal or two and tell them that you just finished working a VK, give him the frequency and suggest he try for him . . . probably no one else there now anyway, and generally there wasn't, and your buddy raised him first call! Utopia? Well, maybe not exactly but it sure was in comparison with what the DX hounds face today!

And what did you do when you'd hooked the guy? Use today's modern procedure, slipping him a quick RST, promise a QSL and beg for his? Maybe a fast 73 and without releasing the mike button or the key knob, jam out a long 'CQ DX' again? Hang on and hog the frequency by all means if you can, seems to be todays popular practice!

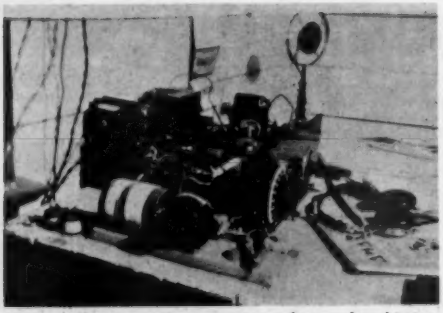
In the thirties, when we'd hook a way-off guy like that, we took keen delight in jawing a bit. What did he do for a living in his country . . was he a youngster . . student maybe, or perhaps a hard working cop in Brisbane? You gave him the low-down on *your* family status, job, weather and similar purely rag-chew matters. You found out a lot about life in foreign climes, thereby broadening your own knowledge of the world and it's peoples. Today you know that the other guy knows what 73, RST and QSL mean, but beyond that you both lose interest and hit the 'CQ DX' trail again! You don't give a tinkers' damn apparently if only the other guy will keep his promise and send you a QSL card!

You present day DX'ers can't be blamed too much though. Just try and do a little yakking with a rare DX station and you won't last long enough to get as far as" . . rig here is home-brew . . ." before the thundering herd is loosed from its corral in all its fury; you 'have no business holding the guy; we too want a chance to tap him on the shoulder and then pass quickly on to spoil another QSO'!

And the gear you used to make your contacts in the late 30's? Receivers weren't too often 'store-bought' although a goodly share of them were pretty much available on the market. Kits were not as yet a factor in ham construction but a lot of good ol' home-

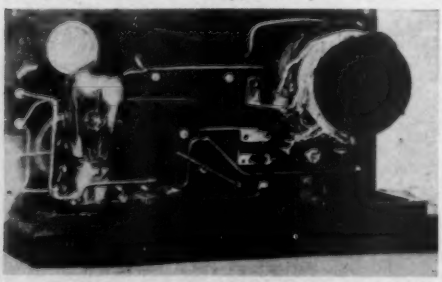


Equipment such as this shown here represented the popular version of a typical ham station of the early thirties.



In the 1920's, and even into the early thirties, vacuum tube transmission was being accepted with a tongue-in-cheek attitude and many stations were somewhat crudely assembled for "experimental" purposes.

brewing was done. The 30's weren't 'high salaried years' by any means remember; laying it on the line for factory-made gear came pretty tough and it wasn't too popular. It was a case of build it if you could, buy it if you had to . . you could get time payment deals even then. Transmitters? Another story; darned few were found with commercial factory labels on them . . home brew was almost invariably the rule. Building your own was relatively inexpensive then. The urge for power hadn't raised its sneaky head with the idea that it took a full kW . . even more if you thought you could get away with it . . . to mow down the mob and insure contacts for *you*. In the 30's, a guy with 100 watts or even less was in the top group of DX chasers more often than not. Two or three hundred watts was found only among the 'plutocrats' . . . the guys with wallets fat enough to afford the parts,— or the *really* exalted beings who could lay it on the line for a shiny, factory-made blaster that would insure *his* position as 'King of the Air Waves', to the disgust and detriment of thousands of fellow hams. The modest power boys were every bit as capable of posting up a DX score as the kW kings if given an equal chance at 'air rights'! Skill, not power, then as now, was the secret of DX contacts that really meant something.



Low-power rigs such as this five watter using a UV-202 tube established some remarkable DX records and played a large part in definitely establishing the superiority of tube transmission over that of spark equipment.

Antennas? Beams were being played with, it's true, but the more popular conceptions of an effective antenna system embraced Zepps, Windoms and often a simple, random length of wire sometimes sporting a 'counterpoise' beneath it; a carry-over from earlier days when an antenna without a counterpoise just wasn't mentioned in the exotic circles of 'upper hamdom'!

Strange as it may seem to you mods, an awful lot of impressive DX work was accomplished then. While my best DX (never exceeded since!) was a bit earlier than the period we are discussing, it was representative. I made it to Moscow, Russia for a report of 'QSA 5, R 4, T near dc' which was how we reported it then. This was in 1931 and I still have the card to prove it! And . . I was using a home-brew rig, parallel 210 tubes in a Hartley circuit running 40 watts input. This was on 40 meters and the antenna was an *eight* wire flat-top 30 feet long against a water pipe ground. I wasn't alone; a lot of my buddies did as well with as crude an assortment of gear. My receiver was still the little Reinartz I had home-brewed in 1922. I was afraid to tackle building one of the relatively new-fangled 'super-hets' and a factory built super was incompatible with a thin wallet!

I'll grant you that in the 30's the QRM problem was considerably less. We had, as I recollect without researching the files, perhaps half as many hams as we have now. Remember too, there was no novice license then which now offers an easy entry into the ham fraternity. You had to make it for the equivalent of the present day General class before you could touch a finger to the key! Consequently, hams entered the fold more slowly and although the growth was healthy, it didn't sky-rocket as it did following the radio training acquired by many in World War II and later establishment of the novice class. Right now, it seems, entry into the ham radio ranks has taken a little dive and new hams aren't being born quite so fast. No really plausible reason seems to have

been put forth, but I'm inclined to go along with those who feel that very likely the creation of the Citizens' Band, requiring no knowledge of code or theory, no exam of any kind, has done a lot to drain prospective hams from the list. Maybe that's good . . maybe not. Fewer hams . . less QRM, theoretically. However, from a practical standpoint, I doubt if it would be noticeable on the air.

So Wayne, does that give you a little rundown on what she was before the great influx into the DXpedition field? Personally, I'm content to rest on my meagre past 'laurels' in the DX field, lurk in the upper ends of the 'CW only' bands and catch the unwary now and then for a nice comfortable QSO without a horde of vicious jabbers laying for me . . hi! . . .W7OE

YLRL 5th International Convention

The Colorado YL Club will play hostess to the 5th International YLRL Convention in Denver, Colorado, June 13-16th, 1968. This promises to be a great convention and it is not too early to begin planning. This takes place just a week after the ARRL National Convention in San Antonio, Texas, so perhaps the OM can be talked into the idea of a combined convention vacation.

Past experience has shown the Colorado YLs to be a group who have tremendous spirit and a cooperation rarely found in any club. There are no "tag-alongs" in this group. Everyone works, and hard! The gals promise a fine affair with the donation prize being a thing called M&M . . . with due appologies to the candy company. In this case, M&M stands for "Mustang and Mobile". A 1968 Ford Mustang complete with a mobile rig and antennas will be given away. If you prefer, you can take $200 cash in place of the mobile rig.

There will be fine accommodations, fine food, tours, lectures, and special events for the OMs (including a tour of the Coor's Brewery). For further information and/or reservations, contact Marte Wessel KØEPE. Marte can be found at P.O. Box 756, Liberal, Kansas . . . or on 14.265 each Thursday at 1800 GMT on Tangle Net.

I'm going to be there, are you? The gals have a slogan going . . . "Don't Forget Our Big Date, YLRL '68" . . . WØHJL

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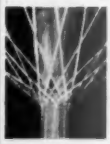

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Wayne Green W2NSD/1
Peterborough, New Hampshire

DX'ing

Some more hints on chasing DX and how to get the most out of your station and your time.

Getting Through the Pileups

Both guile and experience are helpful when you face the impromptu DX contests that develop when a rare DX station suddenly comes on the air. If you have a sufficiently loud signal and it is bouncing into the right spot you can use brute force to get through. If propagation is poor, or your own station is a little weak, you have to substitute brains for brawn and clever your way into the contact.

Those of us afflicted with the need to work new countries spend a lot of time tuning the bands just listening. I think most of us, on twenty meter sideband, use about the same system. We start tuning at around 14,190 kHz and work our way slowly up the band, stopping at each station for a few seconds to see who he is or with whom he is talking. This gives us a good idea of just where the band is open to and from that we keep in mind what countries we might be on the special lookout for in that area.

As we tune on up the band we will, now and then, come to a pileup. We hear many stations all on the same frequency calling someone. Note first what call they are calling, if they happen to be giving the call. This is your first hint. Now and then they will be giving their own call and won't bother to say who is being called. You have to listen a little more in this case. In extreme cases like this I've been known to break in on the frequency and ask who everyone is calling. Someone will usually oblige.

If you notice that the stations calling are not all exactly on one frequency, then you know that the station they are calling is off the channel somewhere. Try tuning for him between 14,190 and 14,200 first. You have to know his call to know which direction to point your antenna, don't forget. If he isn't there then you might try listening down around 14,100 to 14,110. Some DXpeditions operate down at the low end of the DX phone band. If you still hear nothing, check again on the calling frequencies and see if you can find a fellow who has made contact and see what report he is giving. This gives you an idea of how weak a signal you are listening for.

It is worth while to tune up from 14,100 to 14,200 once again, carefully listening for the DX station. You might also check about five or ten kHz below or above the frequency where most of the stations are calling him. If you still haven't discovered him, then break in on the pileup and ask what frequency the DX is on. After two or three calls someone will probably break in and tell you.

Be sure to split your transmitter and receiver, if you are using a transceiver, when you call a DX station that is out of the band. Every now and then you will hear someone who has forgotten to do this, break in on top of the DX and call him. Usually someone else will break in also and tell him to get back in the U.S. band.

If the DX station is outside the band and indicating that he is tuning a range of frequencies for an answer you should listen carefully for the fellow he is working and put your transmitter on that frequency and be ready to call when he signs with the other station. Don't try to break in while the other chap is still talking unless you hear the DX station accept this from others. This is normally considered impolite. You can try "tail ending" and see if that works. As the other station is turning it back to the DX station you can break in quickly and give your call letters. This often works. The major problem facing the DX operator is getting call letters through all the interference. If yours come through clearly, he is very likely to work you. And as long as the DX station is not on the same frequency as you, you won't be interfering

with him.

Take your cues from the DX operator. He will soon let it be known if he likes tail ending or breaking. These can be just fine if there aren't too many stations trying to get through. What is OK for a dozen stations can be bad for a hundred.

If you try to make it on someone's coattails and fail time and time again, then see if you can figure out the pattern of tuning the DX op is following. He may tune up the band and then go back to the bottom and start over. In any case it behooves you to try not to be on the same frequency as anyone else you can hear.

One of the worst operating systems is trying to get in the last call on a frequency. This happens most often when the DX station is transceiving and everyone is right on his frequency. Then we have the spectacle of fellows calling him one after the other with no one stopping long enough to see if the DX station has answered the call. I've heard fellows call a DX station for ten minutes straight, with two or three stations alternating the call and not taking a moment to listen.

Continuous calls can only happen when the DX operator is inexperienced. If the DX op knows what he is doing he will never permit anything like this to develop. The whole situation is really in his hands. What should he do to stop this business of longer and longer calls on his frequency? Well, this comes when the fellows trying to get him find out that he is listening on just that one frequency and that the DX station is waiting until he hears one call come through clearly. Once they find this out they try every way they can to be the last one to call. And this is bad news for everyone involved.

One of the experiments I've made in my travels to many rather remote spots, has been a trial of every system of working stations from a DX location. I wanted to find out which system really worked the pest. Of course, with English being my native tongue I have an advantage over someone with just a recent acquaintance with the language. I can hear call letters a lot easier and faster. After trying every idea I could find for working stations as fast as possible, I settled on the one which seemed to fill my log the fastest.

Perhaps my concept of working DX is a little different from others. I feel that a station in a rare spot has a sort of obligation to give everyone who wants a contact a chance to say a quick hello so that a QSL card can be exchanged. And when you are just working stations as fast as you can, I feel that all of the wasted motion should be cut to a minimum. When I fire up, I exchange signal reports and call letters . . . nothing else. Names are important only if you are going to be talking with someone for a while . . . ditto locations. And why waste time telling me what transmitter or antenna is being used? By keeping the extraneous down I find that I can manage about four to five contacts per minute. This is about 250 per hour. Actually I usually only contact about 200 an hour because I take time out now and then to give my QSL address and to explain my method of operation. These general announcements every few minutes keep the questions to a minimum.

The system whereby the DX station is on one frequency, usually just out of the U.S. band, listening for calls either on one frequency or over a band of frequencies, usually results in about two contacts per minute average. It has the disadvantage of spreading the interference over a wide band of frequencies and thus raising hob with quite a number of other contacts on the band. And you get a lot more interference because so many fellows are not sure when to transmit and when to listen. This is, to my mind, an inefficient and messy way to work DX. Also, this system favors the louder stations and acts to frustrate the weaker ones who are forever getting clobbered by the big signals.

Another system, which works a little better than the above, but still leaves a lot to be desired, is to ask the calling stations to spread out over a band of frequencies and call for a fixed period of time, say two minutes. The DX op then writes down all of the calls he has heard and proceeds to work them on his own frequency as fast as he can. This causes massive interference to the band for a two minute period every few minutes. It isn't a very good system, either.

The method which proved the best to me was one that few others have had success with and thus have been afraid to really try. This is working transceive right on your own frequency. Let me explain the advantages of this type of operation before I

Herb Schoenbohm WØVXO standing on the imaginary line between PJ5 (rare) and FS7 (rarest). His operation from Saint Martin on 160 meters gave W1BB country number 97 on 160 only! This DXpedition earlier this year made stops at PY1NFC, OA4O, FG7XL, VP2AZ, VP2MK, VP2KY, FG7XL/FS7 and WØVXO/KV4.

go into the details . . . and it is the details that make it work where most others have failed with it. When you are making all contacts right on your own frequency you cause the least amount of QRM to the rest of the band. All of the fuss is on one single channel. It is up to you, the DX station, to keep the fuss to a minimum. If you sort out the calling stations properly you will find that you are able to contact even the weakest signals. I often contact mobile stations from just about anywhere in the world . . . fellows who have seldom before been able to work any rare DX because they are not able to brute force their way through the kilowatts. And, since I am able to work stations so fast, no one has to wait any great length of time to get through to me. There is none of this four or five hour calling that some DXpeditions have inflicted on the never-say-diers. I find that it is rare indeed when anyone has to wait more than 20 minutes for a contact . . . and he just has to sit and wait, not call frantically during the 20 minutes.

The whole basic secret is to, first of all, make sure that everyone trying to get you knows that you are listening for one call and one call only. If you don't get the call letters on the one call they are to wait for you to give further instructions. If you get this idea across you will be able to handle the pileup even when your own signal is fairly weak. If anyone starts taking too long to call, just break in on top of him and the others will straighten him out quickly for he will be interfering with you. And don't ever take anyone out of turn. Do not accept a call from a breaker or a tail-ender. Explain that disorderliness will result in a mark in the log that no QSL is to be sent for the contact. Perhaps that is too drastic? Then threaten them with a one year hold up on the QSL for offenders. This is your strong weapon. Try not to get mad when someone is nasty or inconsiderate. Frankly I was astounded at what little problem I had with fellows not following my instructions. The DX'ers will cooperate beautifully when they understand what you want and see that it is to their benefit to cooperate. The DX station who wants to make long winded contacts and just two or three stations a day is going to have a miserable time of it.

Now, to the heart of my "system." I try to find out what areas are coming in strong and which are weak. Those which are fading out, I usually try to work first. It is very frustrating to hear a DX station that you want to work gradually fading out and have no chance to get through to him. The loud stations will be around for a while and you can get them easily. The weaker ones may be gone in 15 minutes. I always explain this in order to let the loud stations know why they have been put aside temporarily. Now, when asking for stations to call, I tell them about the one call rule and then stand by for a call area . . . say the first area. If there are too many stations calling to sort out any call letters I divide the pile up by asking for separate prefixes. I start with the newest prefix first. I've found that if I stand by for W1's that I will get called by W1's, K1's, and WA1's. If I stand by for WA1's, the W1's would rather die than call. Normally there are not enough calling so I can't pick out one call . . . or at least part of the call . . . and then I ask for more WA1's until I have them all contacted and there is no sound when I stand by for more WA1's. Each station gets a signal report from me and nothing else.

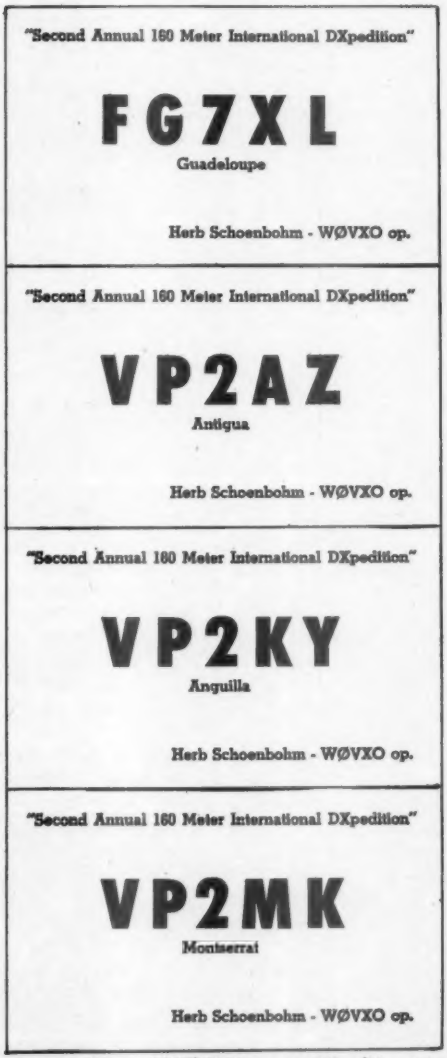
When the K1's and W1's have all been worked I usually stand by for any late arriving first call area stations just to clean it up. One or two show up. When they have been contacted I explain again about one call, my area by area system of contacting, where to QSL, and then ask for second call area calls. If there are more

than a couple I split them up by prefix again, starting with WB2. Particularly weak stations are helped by others who want to speed things up for you.

Every now and then another DX station will break in while you are working. They usually wait their turn patiently too. Many times I've had an HK4 come in when I asked for fours to call . . . or an HB9 when I asked for nines. But generally I try to make the foreign stations feel wanted by standing by for calls from outside the U.S. every now and then between call areas. When there were heavy concentrations of DX stations calling I found that my system of dividing them up by prefix worked almost as well as it did on stateside contacts. You may run into a little trouble now and then, as I have, with stations who are not fluent in English and who do not understand what you are asking them to do. It is easier to work these as they come rather than argue with them. These are usually in Italy and Russia, for the most part.

Well, there is the whole system. If you get to a DX spot I hope you'll remember it. And if you run into a DX operator, hopelessly floundering under the QRM, you might try to get the idea across to him of getting calling stations to call just once and in call area rotation . . . with absolutely no exceptions. There is a great temptation to come back to a breaker who comes through very clearly. You ask if there are any eights that you have missed and a W4 comes through beautifully, giving his call. I write it down and ask him to wait his turn. Then, when I am back to the fours, I give him his report first, rather than making him call again. This speeds things up and few listeners realize what has happened, so I don't run into much breaking like that.

Using this method of operating on sideband, you should be able to get some 2000 stations in your log in an average day of about ten hours. By the time you have 5000 contacted you will find the stations thinning out and you will be reduced to calling CQ, sometimes without any answers. It is a shame that so many fellows in rare spots are wary about getting on the air because they get jammed up with so many calling them. Just a few days of hard work would get everyone off their back. From then on they would be able to talk as long as they like without being bedeviled by breakers for a QSL card. We'll go into the QSL card situation later on. Let me just say that no DX station should ever limit his contacts because of the work involved in making out QSL cards or the expense of the cards or the postage involved. All of this will happily be taken over by a volunteer for you who will act as your QSL manager. The only responsibility of the DX station is to make contacts and send a copy of his log to the manager.



More evidence of WØVXO's recent DXpedition into some of the rarer areas in the Caribbean.

Getting The Time Right

One of the big miseries for DX operators is trying to verify a contact in their logs. About one third of the fellows who send them a card get either the date or the time of the contact wrong . . . or even both. This means troubles. The DX op then has to take his choice . . . try to find the contact in the log, a process that can be very time consuming if he has worked a large number of stations . . . or he can return the card for a better time or date . . . or he can just throw it out. The latter procedure is popular, unfortunately. The next time you don't get an answering QSL you might just take a critical look at your time and date keeping and see if that is the problem rather than the other fellow.

Probably the best thing you can have in your shack is a clock that indicates the time and date in GMT. These are a bit expensive . . . perhaps you can get by with just a GMT clock. I highly recommend the kind with numbers that come up rather than the usual hand type. You can read it a lot faster and there is less likelihood of reading it an hour or five minutes wrong. I particularly like one of the matching consoles, that goes with my transceiver, which has a clock, loudspeaker and phone patch built in.

It doesn't do a lot of good to have the time right when the date is wrong. I don't know why so many fellows have trouble with this, but they sure do. Keep a calendar by the operating desk and try to remember to write in your log the date when you start operating and to note the change of date as 2400 slips into 0000 hours.

Your power company may be completely reliable and once you set your clock it may be giving the correct time from then on. But, unless you are positive that there couldn't have been a short power failure, it won't hurt to tune in now and then to one of the time standard stations. This means WWV or CHU for us here in the U.S. WWV transmits, along with WWVH in Hawaii, on 2.5, 5, 10, 15, 20 and 25 MHz. You can get a time check from them every five minutes. And you should be able to receive at least one of these stations any time of the day or night from anywhere in the country.

While I don't want to appear dissatisfied with the American product, I will admit a partiality to the time signals from the Canadian Observatory via CHU. These come to us on 333 kHz, 7333 kHz and 14,460 kHz. CHU gives you the correct Eastern Standard Time every minute, complete with both voice and CW announcement. Their 7333 channel is usable in most of the U.S. during the day and can normally be copied on ham transceivers. WWV channels usually require an all band receiver since they aren't near any ham bands. Of course, in this day of transistor portables I guess that most of us have a little short wave receiver lying around which can copy at least up to 12 MHz.

Some operators are still using their local time for keeping their logs and this then gets on the QSL cards. Picture yourself in Singapore trying to equate Mountain Daylight Time with GMT so you can locate the contact in your log. If the chap has the patience, he will be on his way to losing it along about the tenth card he gets like this. Moral: keep your log in GMT. This is the world standard, so why try to pick a fight with it at this late date?

It will be handy for you to keep some sort of time chart around the operating desk. The great bulk of the stations all over the world are active on about the same pattern. They often try for a few minutes when they get up in the morning, then you'll find them on the bands after they get home from work in the evening. After dinner, many of them will show up for a while. If you are looking for contacts with the Pacific Islands there is little point in making much of a fuss about it during the middle of their afternoon . . . they are all at work then. But if you check to see what time six in the evening for them is in your time zone, you will stand a lot better chance of getting a contact. Give a check around 8 am their time too. The prime time is from 8-11 pm, providing you find the band is open to that area during that time. You might consider buying one of those world maps which indicates the times in most places of interest. They have a tape which runs past the windows to show the local times.

On weekends you are likely to find stations operating at any time. This is the best time for the late night openings on the lower bands in particular. And when the sun spots are perking well, you will find twenty meters open all night much of the time.

. . . W2NSD

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WTW Report

Things are coming along very fine with many fellows interested in the WTW. More are qualifying all the time, getting low serial numbers on their certificates. QSL cards from the DX stations are coming in pretty well now, and it's certainly possible for almost anyone who halfway tries, to get 100 confirmed countries. The WTW country list is reasonably generous since our interpretation of what is and what is not a country depends completely upon the national amateur radio societies of the world. I suggest that those who are interested drop me a line, enclosing 25c in stamps, and I will send along a few sets of our country list. Each list consists of four pages, printed on both sides, with space for you to use them as a tally sheet for *ten* years. You will need two sets for every mode you are interested in trying for since we want one list sent to us and you retain your copy of what you sent in. This will make our records the same as yours and simplify our joint tasks later on. Just send me 25c in stamps to cover postage and handling.

As you might expect, there are some mistakes in the country/tally sheets with a few countries overlooked in making it up. Please make the following corrections to the WTW country lists that you have: JW prefix for Bear Island, JX for Jan Mayen. The first KG6 should be Marcus Island. On page 2, the second country listed should have the prefix of FO8M for Maria Teresa. Last one listed on page 2 should be JW for Svalbard.

On page 5, after VP2M, enter the letter "K" in front of St. Kitts and Nevis; in front of St. Lucia enter the letter "L" making the prefix VP2L. In the blank space before VQ7, 9, enter VQ9 as Seychelles Islands. In the last blank space right after VS9A, enter VS6 for Hong Kong. On page 6, please note that ZS2M is *both* Marion and Prince Edward Island and is only *one* country. This seems to be all the changes necessary to the list. Of course, the exact way to spell some of the countries may be wrong, but it depends upon who is doing the spelling. Hi. I have seen so many different ways that they themselves spell the name of their country, that I am sure the way I have spelled them you know what place I am writing about.

To save me lots of work, please send to the following fellows/associations if you want a few sets of the WTW country/tally sheets, and, when you have qualified, send your QSL's to them to be checked:

W/K 1: We are still looking for a good club to handle this district. Until one is found deal directly with me-W4BPD.
W/K 2: Same as above.
W/K 3: Western Pennsylvania DX Society, John F. Wojtkiewicz/W3GJY, 1400 Chaplin St., Conway, Penna. 15027.
W/K 4: The Virginia Century Club, P.O. Box 5565, Virginia Beach, Va. 23455.
W/K 5: Same as W/K 1 and W/K 2.
W/K 6: Orange County DX Club, James N. Chavarria, 3311 Sterns Dr., Orange, Calif. 92666.
W/K 7: Western Washington DX Club, Inc., Wm. H. Bennitt (W7PHO), 18549 Normandy, Seattle 66, Wash. 98100.
W/K 8: Straits Area Amateur Radio Club, William Moss/WA8AXF, Petoskey, Mich. 49770.
W/K 9: The Montgomery County Amateur Radio Club, Scott Millick/K9PPX, Box 250, Litchfield, Ill. 62056.
W/K Ø: Same as W/K 1
All of Canada: The Edmonton DX Club, (VE6GX), 12907 136 Ave., Edmonton, Alberta.

"Hop" Hopple, W3DJZ, winner of WTW-200 Single Sideband certificate number 2.

Oceania: The New Zealand Association of Radio Transmitters, Jock White/ZL2GX, Contest & Awards Manager, 152 Lytton Rd., Gisborne, New Zealand.

Hawaii: Use the K/W 6 verification club (Orange County DX Club).

South America: Venezuela Amateur Radio Club, Attention of YV5CHO DX Committee, P.O. Box 2285, Caracus, Venezuela, South America.

Europe: R.S.G.B. (Radio Society of Great Britain).

Africa: Same as W/K1

Asia: Presently same as WK1. We are working on one of the large Asian DX associations now, and will let you know if we can get together.

What with the wonderful conditions these days, I am sure that there's a lot of fun to be had if you enter WTW seriously. I have had some complaints about the QSL problems some of you are having. About the only comment I have about this is—you have not worked the right stations or your approach to the QSL card problem has been wrong. This is borne out by the fact that too many other fellows have received QSL's for their contacts; look at all the fellows who have the QSL's and *have* qualified. There are quite a few over 200 already confirmed and working towards WTW-300. Mind you, this in only the first year. It can be done!

I can use a few good black and white photos with a little background from some of you who have qualified. I would like to have a story about you and your station to run in a future issue of 73. That's it for this time fellows . . .

. . . W4BPD

Worked the World

14 MHz SSB WTW-200

1. Gay Milius W4NJF
2. "Hop" Hopple W3DJZ
3. Dick Leavitt K3YGJ
4. Joe Butler K6CAZ

14 MHz SSB WTW-100

1. Gay Milius W4NJF
2. Bob Wagner W5KUC
3. "Hop" Hopple W3DJZ
4. Bob Gilson W4CCB
5. Jim Lawson WA2SFP
6. Joe Butler K6CAZ
7. Warren Johnson WØNGF
8. Lew Papp W3MAC
9. George Banta K1SHN
10. Dan Redman K8IKB
11. Paul Friebertshauser W6YMV
12. Jay Chesler W1SEB
13. James Edwards W5LOB
14. Bill Galloway W4TRG
15. Olgierd Weiss WB2NYM
16. Jose Toro KP4RK
17. Gerald Cunningham M1MMV
18. Edward Bauer WA9KQS
19. Dick Tesar WA4WIP
20. G. "Gus" Brewer W4FPW
21. Jack McNutt K9OTB
22. Charles R. Sledge W4IVU
23. Ira C. Crowder DL5HH
24. James Leonard W4FPS
25. Richard Leavitt K3YGJ
26. Gordon Read VE6AKP
27. Paul Haczela K2BQO
28. Don B. Search W3AZD
29. Len Malone WA5DAJ

14 MHz CW WTW-100

1. Vic Ulrich WA2DIG
2. James Resler W8EVZ
3. Dan Redman K8IKB
4. Robert C. Sommer W4CRW
5. John Scanlon WB6SHL
6. Newton W. Gephart W9HFB

21 MHz SSB WTW-100

1. Ted Marks WA2FQC
2. James Lawson WA2SFP
3. Joe Hiller W4OPM
4. Scott C. Millick K9PPX
5. Paul Friebertshauser W6YMV

21 MHz CW WTW-100

1. Joe Hiller W4OPM

28 MHz SSB WTW-100

1. James L. Lawson WA2SFP

7 MHz CW WTW-100

1. Rex G. Trobridge W4BYB
2. R. Sigismonti W3WJD

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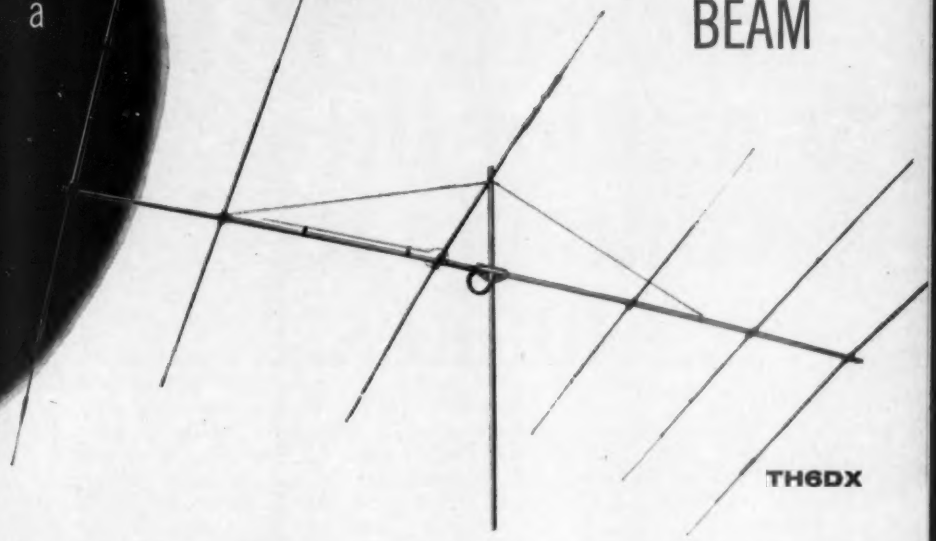

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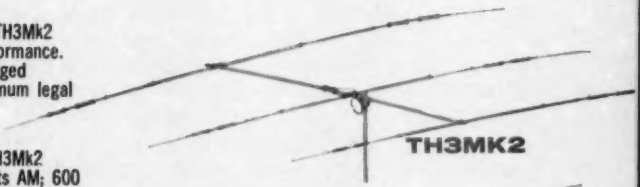

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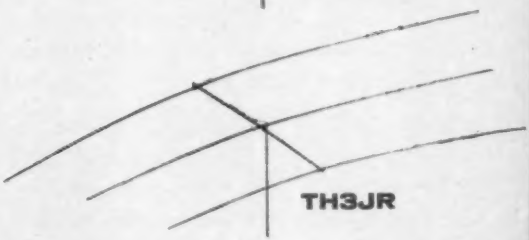

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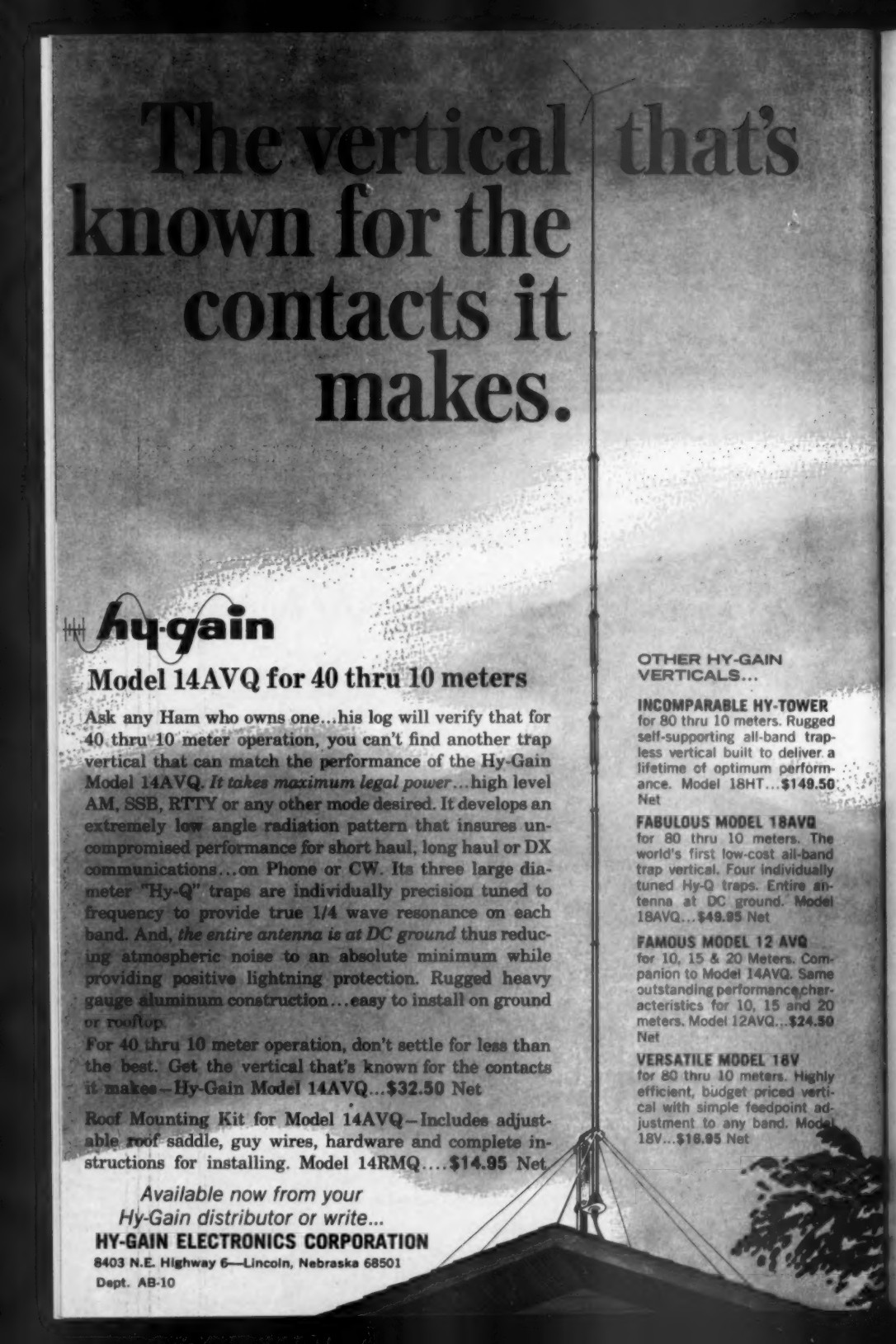

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Gus: Part 28

Bouvet Island

About the 2nd or 3rd day out from Gough Island, the first iceberg was spotted. Just a cold, white hunk of ice floating in the sea. The first one looked to be about the size of an automobile, and they tell me that only about one fifth of it is above water. The further South we went, the more icebergs were seen. You can be sure that they had their special iceberg spotter sitting on the radar all night long.

That night, I went out on deck as usual and the old Southern Cross was nearly overhead. We were getting there, and the winds had that icy feel when they struck me in the face. The next morning when I went out on deck for my usual look around, the sky was completely overcast and it was downright cold, with a capital "C". That was when I went back to my little cabin and hauled out a pair of those "long handles" that K8TRW had sent me, and when I went back out on deck, I felt a lot more comfortable.

All during this part of the trip, I spent as much time on the bands as possible to give the fellows a running account of our progress to the island. I think it would make DXpeditions a lot more interesting if every DXpeditioner would do the same thing. This gives the fellows a chance to follow your progress as you get near that rare spot. I suppose this is what you might call part of the "chase." As you get nearer and nearer to the spot, the fellows will know approximately when they can look for you from the island. This gives them a chance to phone the boss to pull the, "I am sick", deal. I think this is much better than just popping up from some spot without warning and making many of the gang miss you, unless they take off three or four days.

When we were about 100 miles from Bouvet, the sea was completely covered with ice floes. The little ice breaker just plowed into the floes and broke them up into smaller pieces as we went through. They told me about getting caught in the ice once in March, and had to have an American ice breaker come to their aid and break a path for them to get out.

I think it was the 4th day out that we at last saw Bouvet Island in the distance. I got on the air that night and told the boys that I had at last arrived and hoped to land the next morning. I had found that it was sun-up at about 2:15 AM (local time, that is) down there. I got into the sack for a short night's rest at about 11 PM. I was too excited to do more than get an hour or so of sleep before they woke me up to say, "This is it . . . let's go".

Everything was loaded into the big lifeboat, very carefully wrapped in canvas and oil cloths and secured with rope to keep it from sliding all over the boat.

We had found a spot on the map which was on the northwest corner of the island, called "Circumcision Point". Just the right spot for propagation to the USA, Europe, Africa, South America, and even some of Asia. But, the VKs and ZLs were very well shielded by sheer cliffs, both to the south and southeast. This spot was about the size of two city blocks and was well above high tide.

It took about two hours of hard work for us to go the 1000 feet or so from where the ship was anchored to where we wanted to land. The temperature, I estimate, was about 20 degrees and the wind was absolutely murder when it struck me in the face. I had on the following clothing: regular undershorts and shirt, then two pair of those red long insulated underwear, a flannel shirt with long tails, two pair of woolen pants, one pair of regular socks, and then a pair of woolen socks coming about 6 inches above my knees . . . then a very heavy turtle neck sweater. I also had a wool headpiece covering all but my eyes, and a big heavy overcoat and last but not least, a pair of fur lined gloves coming almost to my elbows. *And I was still cold!*

Getting all my stuff ashore was no easy task and to this day I'm surprised we didn't lose some of it in the rough swells which kept hitting us. But we made it . . . I was at last on Bouvet!!!

I had an African chap, and lots of penguins to keep me company. We had lots to do after the lifeboat departed. A tent to put up, an antenna to install in frozen ground, the putt-putt to get cranked, a fifty gallon drum of petrol to roll up to the point I had selected for it, a tank of compressed gas,

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and even a small gas heater had to be moved to the camp site.

At last I had arrived at this bleak, frozen, ice and snow covered island some 1,500 miles southeast of Capetown, South Africa. We were there in what they call mid-summer—around the fifth of December. The ice pack was some 150 miles or so north of the island, and it took a South African ice breaker to get through all that frozen ocean. I sure would hate to try going there in a smaller boat even in their "warm season".

The island from a distance looked like a very large chocolate cake with white frosting on its top side. The top of the island (at least about 9/10ths of it) is a high plateau, and this portion was covered with a glacier some 200 to 300 feet thick. This glacier was making all kinds of noise all day long and all night long; cracking, popping and snapping. Then there was a tremendous splash when a big chunk of this frozen snow dropped off to the ocean below. These chunks at times were as large as two or three moving vans.

When the bands quieted down, it was interesting to watch and listen to things happening to that ice. But to me the penguins and other bird life were even more interesting, as well as a number of seals and sea lions which hung around all the time. At times these sea lions would have a fight and what a lot of roaring and grunting took place! Trying to count the penguins was an impossible task since they were always on the move. At first they were very friendly, in fact this business of being friendly was the biggest trouble with them. It got to the point where we became the center of attraction to them. They were not afraid of us at all, even when we had to use a small piece of aluminum pipe to keep them a distance away from us. Everything we did there was difficult—did you ever try driving a piece of aluminum pipe into frozen ground? Well we finally got it down, not too deep of course, but when we got ready to depart it was frozen solid and we could not get it out of the ground. It's probably still right there where we drove it in! Getting the tent anchors in that frozen ground was a little difficult too, even though they were made out of sharpened pieces of steel. We put up our little "pup tent", size about 4 by 6 feet. Not enough room for our two folding cots and the card table for the rig. This card table ended up being placed

at the entrance, when the flaps were extended, the operating position was about 50% shielded and about 50% out in the open. I operated with my folding chair right up against the end of the cots facing out, I was in the shelter, but the rig and most of the operating table was outside the tent. The antenna (a vertical Hy-Gain) was 33 feet from the rig and the "putt-putt" (power plant) was 250 feet away. After battling those doggoned penguins every step of the way we finally got everything put together and connected up. My hands were nearly frozen, even though I had on a pair of fur lined and covered gloves. You can be sure it crossed my mind that no one back in the states, in their well heated houses or apartments had any idea of all this happening to me. Even to this day, it's amazing to me that I stuck to the task, freezing, with teeth chattering, doing all this to give the boys another new country. The DXing bug must have given me encouragement to overcome all this and to put up with all this "ungodly" hard and miserable work to give the boys all over the world a little more excitement and something to chase again. I don't think there is a thrill in the world that's more exciting than to be the center of attraction to thousands of DXers with all of them in there madly calling you for that "new one". I sure wish I had a better command of the English language so I could describe this feeling to you. If you are a true DXer and have snagged some new ones, you have just a small idea of how I felt at Bouvet as well as at the other Brand new countries I put on the air for the first time. Even right now, sitting here in Cordova, South Carolina, writing this article gives me another thrill, thinking about it again. Even with all the things that happen each day to make these events slide to the back of your mind, you still have time to lie in bed at night just before you go to sleep and think back on all these wonderful experiences. Up to this time I am quite sure that Bouvet island is the high spot on my list of experiences I have gone through, at least up to this time —of course later on putting Tibet, Bhutan, Sikkim, and even Red China on the air, almost exceeds the excitement of the Bouvet Island operation. Just like the Gough Island operation; right after the tuning up, there was ZS1RM (Marge-in Capetown again) in there, she just said (on CW), "Gus?" Back I came and said "yep, it's me Marge." Then

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the world fell in on me. More doggoned stations calling than I have ever heard, even up to this day of DXing. I had kept everyone well informed as to my progress on the way to the island by operating MM all the way from Gough Island until Bouvet was sighted. Since my "ETA" had been given out to the boys, they all were on hand, standing by for me when I fired up. Many of them I found out later had stayed at home, playing sick, or taking their vacations so they would not miss this one. I know, with all those thousands calling me every minute of every day I operated, that some of them never did make the grade—to these I say I am sorry —I sure wish I could have stayed longer. I did stay 4 and ½ days and operated practically around the clock while down there—total number of QSO's at the end of that time was almost 5,000 and still the pile-up sounded larger than the first day there. It was great fellows! The thrill is still with me when I sit or lie back and think of it all.

The first night there was "something", yes sir. When the sun went down (about 10:30 at night), those darned penguins crowded around the tent when I turned on the light over the operating table, and it was a continuous battle, with both me and the South African chap beating them off trying to keep them from coming into the tent. Those pretty little fellows, that look so tame and helpless, are real rough ones when they struck us on our legs with their little stublike wings and it was not beyond them to, at times, take a nip at you with their beaks either. We soon got to the point where it was no fun battling these creatures all night. I kept the South African chap rather busy most of the time pouring "petrol" in the "putt-putt", and trying to control the penguins. In between times he would crawl into the sack to keep warm.

The little gas heater sure did come in handy. When I was operating, I usually had an army blanket over both me and the whole rig; with a kerosene lantern burning between my legs to attempt to keep warm. The second night there we had a snow storm. It must have been a five or six foot snowfall. When it started falling and started to get real cold, the wind felt like it was directly from the South pole and the temperature fell down to about 15 degrees (F). To me, it felt like minus 15, and snow came down it seemed in

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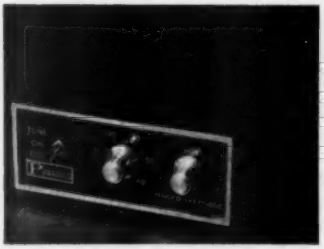

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"chunks"—it was so darned cold, I just QRT, and to keep warm, crawled into the sack, putting the little heater at the foot of our cots and closing the flaps. The heater was turned up "wide open" and I was so doggoned tired I am sure I was sound asleep in about 2 minutes. I had set the alarm clock to go off at 5 AM the next morning and I am glad to say I am a very light sleeper. I think the bell on the clock clanged about once and I reached over and turned it off and leaned over and turned up the lantern which had been burning all night. I intended on going outside to crank up the putt-putt and get going on the air. I found that I could not even open the test flap! I woke up the helper in the other cot, and we both finally got the tent flap open and found that the tent was almost covered with snow. It was broad daylight at this hour down there, and the sun was up nice and bright. We went out to the power plant, and after trying about 15 minutes we could not get it cranked at all. Then we drained out all the oil and took it back to the tent and put it over the little single burner gasoline stove to get it about to the boiling point. We rushed it back to the power plant and poured it in quickly and then primed the engine by pouring raw gasoline directly into the spark plug hole. The very first pull on the cranking cord, she started off and I was back in business as LH4C! I went back to the Rig and found the SWR up to about 5:1 then it dawned on me that the snow had the antenna base drowned—we practically dug our way to its base and found the snow about 4 feet deep and away we went with our snow shovels and removed the snow from around the antenna (we did not worry about the ground plane radials being covered). The first "One by one CQ" produced the right results—sounded like a thousand fellows calling me—and before that first call I had only heard two stations having a rag chew. Everyone must have been standing by just for me!—The "Gus watchers" were really on the job that morning. Everytime you worked one, it seemed two took his place and the pace never did seem to slacken even up to the last day of operation. Nothing like this had ever happened before, and to this day I still get a thrill thinking about it all.

. . . W4BPD

Jim Fisk WIDTY
RFD 1, Box 138
Rindge, N.H. 03461

Knight-Kit T-175 6/10-Meter Linear Amplifier

With the tremendous band openings on six and ten that are due this winter and next, a little extra power will help in getting through the QRM to work that new country or state. If you're presently getting along with a one-to ten-watt peanut whistle such as the Knight-Kit TR-106, the T-175 linear amplifier is ideal. It is particularly useful with small transistor transmitters where you want a little more zap.

In addition to operation as a grounded-grid linear amplifier on AM, SSB and CW, it may also be plate modulated for high-level AM operation. It will run 120 watts on AM linear *and* plate-modulated AM, 150 watts on CW and 300 watts PEP on single sideband. Drive requirements for AM are one to four watts, seven watts on CW and up to 15 watts PEP on SSB. These requirements fall right in with several low-power transmitters and transceivers currently on the market.

Although the T-175 linear is not a band-switching unit, it may be used on either six or ten meters by simply wiring in the proper final coil during construction. By using a coil which is designed specifically for the band in use, efficiency is considerably increased over a bandswitching arrangement where design compromises must be made.

When I first built the amplifier, I put in the ten-meter coil so I could run some comparisons with a popular five-band 300-watt sideband transceiver. With about 10 watts of SSB drive, I could load the T-175 up to the same power output as the transceiver. The DX stations I worked couldn't tell the difference when I switched from one unit to the other. A quick check with the scope showed no flattopping or distortion

when driven with the low-power exciter, but when drive exceeded about 15 watts, some distortion was discernible (on sideband).

Linear AM operation is much more critical than sideband, but when the T-175 is tuned up according to the instruction manual and the grid bias is properly adjusted, there is no distortion. Of course, there is no problem at all with CW operation and when plate modulated with an external 60-watt modulator, excellent results (and reports) are obtained.

After extensive testing and signal comparisons on ten, I pulled out the ten-meter coil and put in the six-meter coil. I had been running a low-power transverter for local contacts on six, and the extra power afforded by the T-175 was a welcome addition. DX stations I had called in vain during previous openings often came back after the first call. Since I live in a channel 2 fringe area, I was a little concerned with possible TVI problems, but even with no low-pass filters installed I didn't experience any difficulty until I got above about 52.5 MHz; TVI problems above this point in the band were quickly eliminated with a Drake low-pass filter.

The circuit of the T-175 linear amplifier is quite straight forward—two horizontal deflection tubes (6JE6A's) are connected in parallel grounded grid. With class-B operation, excellent performance is obtained on AM, SSB and CW. A fan is included to keep things on the cool side and a pi network is used to couple into coaxial lines from about 25 to 150 ohms.

One extremely nice feature of this amplifier is the built-in relay amplifier (12AT7). With this tube in play, no external switching is required to turn the linear on when you go to transmit. A small amount of rf energy is picked off the input, rectified and filtered, and fed to the 12AT7 grid. Normally this tube is cut off, but when transmitting, the rectified rf signal turns it on and picks up the relay in its plate lead. This relay connects the driver to the grid circuit of the power amplifier, connects the antenna to the output pi network and turns on the fan.

If you want to operate the exciter barefoot, you simply put the control switch on standby. This disconnects B+ from the relay amplifier, thereby preventing the control relay from being activated. In this configuration, the driving signal bypasses the power amplifier and is connected directly to the antenna. The relay amplifier is also used for CW operation, but above 12 WPM, the relay is too slow to follow the dots and dashes, and it must be continuously activated by a simple resistor substitution.

Knight-Kit T-175 Specifications

Frequency range:	Two coils provided; 27-30 MHz and 50-54 MHz.
Power input:	120 watts AM linear or plate-modulated AM; 150 watts CW; 300 watts PEP SSB.
Drive requirements:	1-4 watts AM; 7 watts CW; 15 watts PEP maximum SSB.
Input impedance:	50 ohms nominal.
Output impedance:	50 or 70 ohm coaxial line. SWR less than 3:1.
Tube lineup:	Two 6JE6A output amplifiers; 12AT7 relay amplifier.
Power supply:	Silicon rectifiers. Fullwave voltage-double high-voltage supply. Halfwave voltage-double bias supply.
Features:	Meters on front panel for plate current *and* grid current/relative power. Forced air cooling during transmit.
Power requirements:	110-130 Vac, 60 Hz, 220 watts maximum, 45 watts on standby.
Size and weight:	5½ x 13½ x 11 inches. 20 pounds.

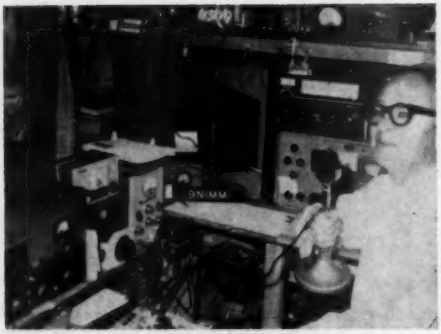
Construction of the T-175 linear amplifier is very straight forward and you shouldn't run into any difficulty if you follow the excellent instruction manual. All of the parts are clearly labeled and the hookup wire is provided in precut lengths. Proper layout on six meters can sometimes be a problem, but in the T-175 no trouble was experienced within stability or parasitics. The design is simple, efficient and trouble free.

During the time I have been using this linear amplifier on the air, all the signal and audio reports have been excellent. When running AM linear, some of the operators I have worked have been quite surprised to find that I was *not* using high-level plate modulation. Television interference complaints, even on six meters, have been nil and the extra power available has aided immeasurably in adding states to my six-meter list.

If you're doodling along with low power on six or ten, here's an easy and economical way to really work out. A few evenings work and a good antenna, and you'll have one of the best signals on the block. And, when you add up the cost of the parts in the T-175, it would be pretty hard to come up with a comparable homebrew linear for the same price. At $99.95 it's a darn good investment.

Oh yes, it will work on the 11-meter class-D citizens' band too, but don't do it in the United States, it's highly illegal!

... W1DTY



Father Moran 9N1MM in his shack.

her and China. With the opening of the road and the airport things have changed completely. U.S. A.I.D. came in first and then Russia, China, Israel, and others came in to help. The U.S. seems to be doing a good job and there are some 200 Peace Corps members here . . . well thought of.

Bob, his wife Martha, and son Mike get their food from the American Embassy commissary. We had dinner at his house . . . roast beef, roast potatoes, cole slaw, and wine. It was a rather normal American meal . . . way up here in Nepal.

After dinner we drove to St. Xavier's School, set up by Father Moran in 1954. We dodged the sacred cattle and people on the narrow streets. Bob explained that if you hit either cows or people, it is best to keep right on going and go directly to the Embassy and let them sort it out. The people can get very excited and become a mob. Seems to me I remember they had this problem in India after the last war. Drivers would often be executed on the spot, even when an accident wasn't their fault.

Father Moran worked with Hillary on the Everest expedition, and made a very good

Bob and Father Moran.

name for amateur radio. Everest is about 15 days walk from Katmandu . . . there are no roads. But, in spite of the value of amateur radio, no one has been able to get official permission to operate except Father Moran. The attitude of the government seems to be the same as down in Afghanistan . . . go ahead and operate, just don't ask for a license. The trouble with this arrangement is that, if for some reason the Nepal government ever gets mad at some country they can then turn around and make a big deal about the illegal amateur radio station run by a national of the troubling country, etc. Bob would like to get on the air, but since he is attached to the Embassy he is afraid to take the chance.

The school is a lot larger than I had imagined. We took my bags up to a sort of monastic cubicle and then put 9N1MM on the air for a little bit. I worked a bunch of Europeans, but didn't hear a signal from the U.S. Ed, from Kabul was on and we had a short contact . . . also a couple of Japanese stations came through for a few minutes. Then the band went dead. The rig is a Viking with a Drake receiver and a three element beam up on the roof. It works out rather well, considering the remoteness of the location and the valley it is in. The U.S. is difficult to work from here, being across the North or South pole.

About six the next morning, one of the fathers walked through the school ringing a little bell to wake up the children. About 250 boys live at the school, another 200 live in town and come to school every day. There is also a girls school nearby for about 500 girls . . . and a high school just around the bend. I had awakened around 5 AM. For that matter I woke up a good many times during the night too. The bed I was sleeping on was not in any danger of collapse. It was made of very solid, hard planking and every bone in my body felt bruised. I rolled over and over during the night to distribute the damage as much as I could. Even after eight hours in bed I was tired clear through.

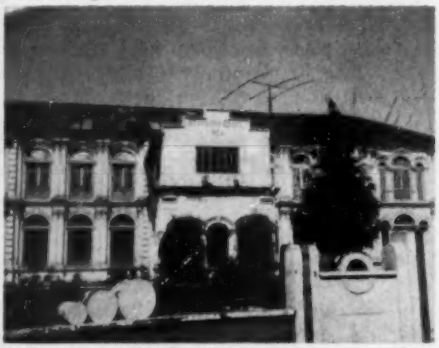
After some forty years of taking a bath every morning the beginnings of a habit seem to be forming. Here I found myself with the choice between a cold vat of water or no bath at all. I decided that I would rather feel scrubby than turn into an iced ham. They have not invented hot water here . . . unless you light the little kerosene stove and heat a pan of water on top of it. This

is probably for shaving.

Father Moran came by my room and explained that twenty meters was a bit weak this morning. I went to the radio shack and listened. The only U.S. station was W4PAA in Orlando. I called Jack a few times, but he wasn't listening very carefully. I chased every signal that managed to break through. Bob had left a cooler with some Coke in it the night before . . . plus some chocolate cake wrapped in aluminum foil. Breakfast was a long way off yet so I broke out a Coke and tried to open it with my Swiss Army knife. I got it open, but the knife went on through the side of the can, spilling Coke all over the table. I quickly put the can to my mouth to catch the flow of Coke and managed to slice both my thumb and my lip, adding a nice touch of blood to the meal. I grabbed a towel to sop up the Coke from the table and then went to the bathroom again to rinse out the towel. It wouldn't rinse out. The best I could manage was a rather nasty brown stain.

I also learned about eating cake from foil. The icing sticks to the foil and the cake crumbles all over everything. It was a mess . . . icing on both hands, on the Coke can, face, and shirt. The crumbs were in a three foot circle around me. By the time I got this all cleaned up the band was completely dead.

A little later Father Moran took me down to Bob's house again . . . breakfast of pancakes, scrambled eggs and sausage. That was the first real American breakfast I'd had since leaving the States two months earlier. I got to thinking that if they are living about the same as at home, they probably have a shower. They did, and I took one, complete with shave. I felt a lot better



St. Xavier's School in Katmandu . . . note three element twenty meter beam on roof.

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and was now ready for the sight-seeing tour.

We all piled in Bob's Chevy. Bob wishes that he had brought over a Rover or Jeep instead of the Chevy . . . they have those kinds of roads over here. He could sell the Chevy for about $5000 here, but the Embassy has a rule that anything over the original purchase price for the car must be given to charity.

Father Moran walked through the two or three blocks of the downtown area with me, pointing out things of interest for me to photograph. I'm afraid that some of the sculptures on the temples are much too graphic for our advanced civilization and I will have to keep the pictures of them for private showings. The city is very old and the stores are just little stalls along the sides of the streets. Most of the roofs have grass growing on them. And here and there are mats in the street with red peppers drying on them. Their curries must be every bit as hot as those in India.

We passed quite a few men and women walking into town with heavy loads on their backs . . . fruit . . . wood. These loads are worth about 3 rupees . . . 4¢ . . . and the wood they bring will keep a family in cooking wood for two weeks. These men bring their loads in from about two days out. They make the four day walk for about 4¢. Everywhere we walk or drive we have to be careful to avoid the sacred cows and dogs sleeping in the streets. Bob explained that a few years back they decided to make the cows unsacred, but they disappeared into steaks at such a rate that they hurriedly made them sacred again to preserve them.

On a hill overlooking the town, we visited a temple and I took pictures of Katmandu in panorama . . . and the monkeys running wild all over the place.

Since I was supposed to take a late afternoon plane to Calcutta, we stopped off at the airline office in town to reconfirm my flight reservation. "So sorry, the schedule has been changed and you have just missed that plane." There was a flight tomorrow, so I would be in Nepal for two days after all.

After a lunch at Bob's, Father Moran drove me back to the school and I got on the air for an hour or so. Ray, VK3ATN was on and he had made arrangements for me to cut short my coming visit to Sydney by one day and come up to Birchip to see his two-meter moonbounce installation. They had made arrangements to have me flown by

private plane from Birchip to a city where I could get a commercial flight to Sydney. Since they had gone to so much trouble I couldn't let them down. I agreed to the change in plans, hoping the Sydney gang wouldn't be too put out.

The extra day in Nepal was welcome, except for the thought of that hard bed again. I'm just too used to soft living. The temperature is wonderful, about 75° during the day and 70° at night.

I sat at the rig working stations as fast as I could until called for afternoon tea with the fathers who run the school. Then, after talking and teaing, back to the rig until time to go to Bob's for dinner. Steak, baked potatoes. Another American couple dropped by after dinner and we all sat around and talked until about 9:30 . . . bedtime. Father Moran drove me back to the school and I spent a fitful night listening to the mosquitos just outside the net around the bed, and turning over and over trying to find some unbruised bone from last night.

Just as soon as the morning bell was tinkled I headed for the shack . . . dead band. Not a whisper. The town power failed about 6:30 and never came on again while I was there . . . until noon. No one seemed to pay any attention, so I assume that this is normal.

Breakfast at the school was a little more spartan than at Bob's, but it was American oriented with corn flakes and fried eggs. After breakfast Father Moran drove me down the road to see the Tibetan refugees. When the Chinese communists invaded Tibet, fifteen thousand people escaped into Nepal. Nepal ignored them and they were starving when Father Moran came to the rescue. He got the Swiss to furnish equipment for weaving, and to export their finished products to Switzerland for sale. They make beautiful carpets and jackets. I immediately bought a jacket for myself and have since seen them for sale, even in the U.S. Up in my hometown of Littleton, New Hampshire I spotted one of the Tibetan-Nepal jackets for sale in the Carol Reed Ski Shop.

The Tibetans shear the sheep, card the wool, spin the wool into yarn, dye the yarn, weave the rugs and cloth, and end up with the finished products. This is all done by hand in small buildings on the outskirts of Katmandu. This industry has saved these people from starvation. I was interested to watch the girls making the patterns in the

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carpets. These are modern designs of the old dragon themes. They have a sample carpet in front of them and count off the stitches on each row. Each row is banged tight with a hammer so that these carpets are extremely solid. We stopped off in the shipping department, and I found that they get about $40 for a 4 x 6 rug. I bought the jacket for about $15.

We picked up my bags, paid a visit to the American Embassy where I saw a couple beatniks, complete with beards, worn trousers and bare feet . . . Americans, naturally. Even up here! We took time for me to have one more shower and shave at Bob's house . . . and then to the airport and Royal Nepalese Airlines to Calcutta.

Father Moran certainly did make my short visit to Nepal something which I would never forget. Before the trip I tried a couple of times to keep schedules with him, but I could never quite get him through the QRM. He said that he heard me coming through fine. Frustrating. The more I get a chance to operate in remote spots like this the more respect I have for the fellows with the power and the big beams. It takes a big signal to get through to here most of the time. Oh, you can make it a few days of the year with medium power, but you can get through almost every day with a big signal. Now, if only Father Moran had a good signal on his end!

On the plane ride to Calcutta, I noticed that they were playing very strange music. Could this be Nepalese music? Then, after I listened for a while, I realized that they had the tape in their recorder backwards and that it was regular American music. I'll bet they don't know it's backwards.

The extra day in Nepal cut my Calcutta stay to just one evening. More about that next month . . . and even more important . . . one of the most astounding countries of my entire trip: Burma. I am willing to bet that you don't have the slightest idea what is going on in Burma today . . . almost no one does . . . and it is virtually impossible for anyone to get into Burma to find out.

Contest Cheating

The contests are upon us and soon we will find our favorite bands awash with number swapping on weekends. Hundreds, sometimes thousands, participate to some extent in these marathons, but only a few dozen hard core psychopaths, bent on proving their superi-

ority, make the serious effort necessary to win that most coveted of all awards: a teeny-weeny printing of their call in an obscure column in QST or CQ.

Those of you who have entered past contests know that politeness and ethics sink into an abyss in the heat of the fray. Possibly you have entered a few contests and wondered why, when you worked so hard and seemingly did so well, that others came out way ahead of you?

The method of cheating depends upon the contest. The QST Sweepstakes contest not only invites cheating, but virtually demands it. This has been a laughing stock of ham radio for as many years as it has been around. In years gone by we would all read the list of winners, enjoying the fellows who ran 304TL's and claimed the low power multiplier. Their answer was simple, if they didn't claim the multiplier they wouldn't win. So we watched the yearly list of "winners" who, almost without exception, had to perjure themselves to get in the winning list. This is still going on and if you enter this contest you had better figure on lying if you want to win.

In all of the contests there is an arrangement whereby you can work multipliers. This can be ARRL sections, countries, etc. This is a natural area for creative cheating. The idea is to add in a few extra multiplier contacts to build up that final score a bit. Be shrewd about this padding, for the contest scorers are not completely unaware that this is a temptation. One system that has been proven not to work by one of our top DX'ers, is the leaving of blocks of contacts open in the log for later filling in. Our very well known friend was disqualified two years running for this stupidity. No, it is a lot better to leave an occasional open spot in your log as you go along. When you have a little break between contacts you can just leave a number open for later use. Then, when the contest is over, you can go back and fill in these blanks with the calls of stations that might have been on, but which were not active in the contest. Give yourself a low number from them, perhaps a two or three. You can easily add ten or so countries to your multiplier and it will be almost impossible to detect for the scorers. You have to know your stuff for this, for if you use the call of a station active in the contest it is too simple to check in the other log. And if you use the call of an inactive station the scorer might

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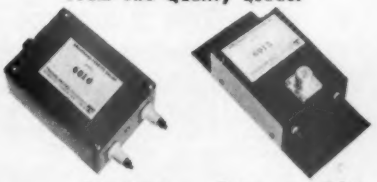

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just know this and the fat would be in the fire.

Perhaps it is time for us to take a good second look at the contests that are cluttering up our bands and decide whether they are worth the spectrum they take. The chaps running the contests are perfectly aware of the problems they have created and seem uninterested in doing anything to solve them. Until they can clean up their contests which demand cheating for a top score, shouldn't they spare us the weekends of chaos?

. . . Wayne

Push to Talk or Speak to Talk

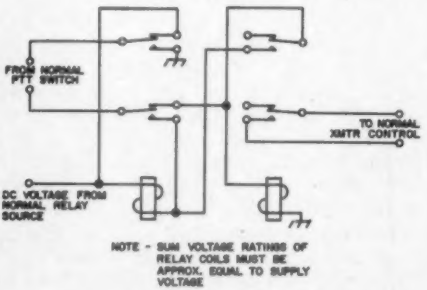
Controlling a transmitter is a common problem; push to talk is simple and effective, but it can be tiring if the QSO goes on for long. VOX is common, but it presents other problems as well; anti-VOX and background noise put the "bug" in this system.

Here's a simple idea to change from push to talk, and hold, to push once to talk and release, push again to stop transmitting. It may take a little getting used to, but once you're "on to it", it is simple and safe. It combines the sureness of push to talk with the convenience of VOX.

To operate, push your push-to-talk button once and the transmitter will stay on even when it's released. After your "speal", push again and your transmitter goes off.

If you're lucky, you may have two relays in your junk box; they can be any type as long as the voltage of both in series is under the supply voltage.

. . . David Collins VE3GLX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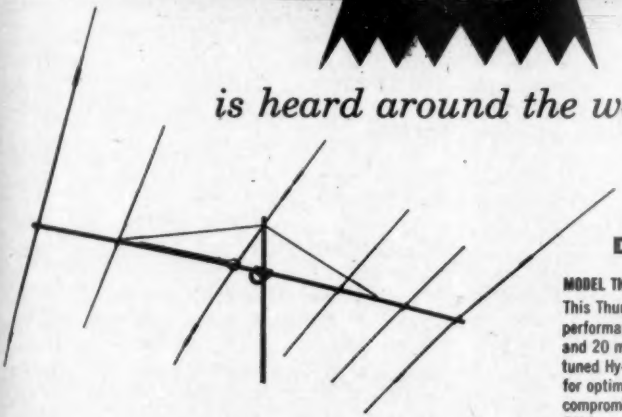

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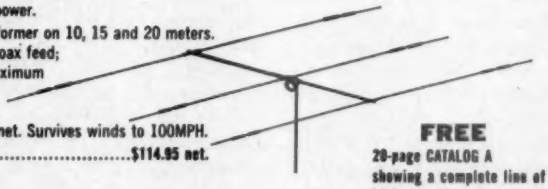

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Technical Aid Group

The response to the Technical Aid Group was a little slow to start, but now the members are reporting that their mail is picking up momentum. Only one major problem seem to have cropped up: a manufacturer has asked one of our TAG members to design an electronic organ! This is *not* the reason that TAG was formed; it was formed as a ham-to-ham aid group helping hams with their technical problems, whether they are 73 readers or not.

If you have a question which can be answered adequately through the mail, look through the following list of TAG members, and write to one whose specialty covers your problem area. Be sure to write legibly and include a self-addressed stamped envelope with your request. TAG members are not obligated to answer queries which do not include a SASE.

If you feel you are qualified to help other hams and would like to join the Technical Aid Group, write for complete details. To do the most good, and to provide the best coverage, we need TAG members in all parts of the country.

Although 73 will help the Technical Aid Group with organizational help and publicity, we want it to be a ham-to-ham group helping anyone who needs help, whether they are 73 readers or not.

John Allen, K1FWF, high school student, 51 Pine Plain Road, Wellesley, Mass. 02181. HF and VHF antennas, VHF transmitters and converters, AM, SSB, product data, and surplus.

Bert Littlehale, WA1FXS, 47 Cranston Drive, Groton, Conn. 06340. Novice transmitters and receivers, AM, SSB, HF receivers, test equipment and homebrew projects gone wrong.

Bob Groh WA2CKY, BSEE, 123 Anthony Street, Rochester, New York 14619. Specializes in VHF/UHF solid-state power amplifiers, but will be glad to make comments on *any* subject.

Jim Ashe W2DXH, R.D. 1, Freeville, New York. Test equipment, general.

G. H. Krauss WA2GFP, BSEE, MSEE, 70-15 175 Street, Flushing, New York 11365. Will answer any questions, dc to microwave, state-of-the-art in all areas of communications circuit design, analysis and use. Offers help in TV, AM, SSB, novice transmitter and receivers, VHF antennas and converters, receivers, semiconductors, test equipment, digital techniques and product data.

Don Nelson WB2EGZ, EE, 9 Greenridge Road, Ashland, New Jersey 08034. VHF antennas and converters, semiconductors, selection and application of vacuum tubes.

Stix Borok WB2PFY, high school student, 209-25 18 Avenue, Bayside, New York 11360. Novice help.

Clyde Washburn K2SZC, 1170 Genesee Street, Building 3, Rochester, New York 14611, TV, AM, SSB, receivers, VHF converters, semiconductors, test, general, product data.

Richard Tashner WB2TCC, high school student, 163-34 21 Road, Whitestone, New York 11357. General.

J. J. Marold WB2TZK, OI Division, USS Mansfield DD728, FPO San Francisco, California 96601. General.

Ira Kavaler, WA2ZIR, BSEE, 671 East 78 Street, Brooklyn, New York 11236. SSB transmitting, color TV, computer programming and systems, digital, radio and remote control, rf transmission lines, dipole design, audio amplifiers, linear and class C rf amplifiers.

Fred Moore, W3WZU, broadcast engineer, 4357 Buckfield Terrace, Trevose, Pa. 19047. Novice transmitters and receivers, HF and VHF antennas, VHF converters, receivers, AM, SSB, semiconductors, mobile, test equipment, general, product data, pulse techniques, radio astronomy, bio-medical electronics.

Theodore Cohen W9VZL/3, BS, MS, PhD, 261 Congressional Lane, Apartment 407, Rockville, Maryland 20852. Amateur TV, both conventional and slow-scan.

Walter Simciak, W4HXP, BSEE, 1307 Baltimore Drive, Orlando, Florida 32810. AM, SSB, Novice transmitters and receivers, VHF converters, receivers, semiconductors, mobile, test equipment, general.

James Venable K4YZE, MS, LLB, LLM, 119 Yancey Drive, Marietta, Georgia. AM, SSB, novice gear, VHF, semiconductors, and test equipment.

J. Bradley K6HPR/4, BSEE, 3011 Fairmont Street, Falls Church, Virginia 22042 General.

Wayne Malone W8JRC/4, BSEE, 3120 Alice Street, West Melbourne, Florida 32901. General.

Bruce Creighton WA5JVL, 8704 Belfast Street, New Orleans, Louisiana 70118. Novice help and general questions.

Douglas Jensen, W5OGJ/K4DAD, BA/BS, 706 Hwy 3 South, League City, Texas 77573. Digital techniques, digital and linear IC's and their applications.

Louis Frenzel W5TOM, BAS, 4822 Woodmont, Houston, Texas 77045. Electronic keyers, digital electronics, IC's, commercial equipment and modifications, novice problems, filters and selectivity, audio.

George Daughters WB6AIG, BS, MS, 1613 Notre Dame Drive, Mountain View, California. Semiconductors, VHF converters, test equipment, general.

Glen H. Chapin, W6GBL, 3701 Trieste Drive, Carlsbad, Calif. 92008. HF and VHF antennas, novice transmitters and receivers, VHF converters, semiconductors, receivers, AM, SSB, general, surplus.

Tom O'Hara W6ORG, 10253 East Nadine, Temple City, California 91780. ATV, VHF converters, semiconductors, general questions.

Steve Diamond WB6UOV, college student, Post Office Box 1684, Oakland, California 94604. Repeaters and problems regarding legality of control methods. Also TV, novice transmitters and receivers, VHF antennas and converters, receivers, semiconductors, and product data.

Orris Grefsheim WA6UYD, 1427 West Park, Lodi, California 95240. TV, HF antennas, SSB, VHF antennas and converters, receivers, semiconductors, and general questions.

Hugh Wells, W6WTU, BA, MA 1411 18th Street, Manhattan Beach, Calif. 90266. AM, FM, receivers, mobile test equipment, surplus, amateur repeaters, general.

Howard Krawetz WA6WUI, BS, 654 Barnsley Way, Sunnyvale, California 94087. HF antennas, AM, general.

Carl Miller WA6ZHT, 621 St. Francis Drive, Petaluma, Calif. 94952. Double sideband.

Howard Pyle W7OE, 3434–74th Avenue, S.E., Mercer Island, Washington 98040. Novice help.

Ronald King K8OEY, Box 227, APO New York, New York 09240. AM, SSB, novice transmitters and receivers, HF receivers, RTTY, TV, test equipment, general.

Charlie Marnin W8WEM, 3112 Latimer Road, RFD 1, Rock Creek, Ohio 44084. General technical questions.

Michael Wintzer DJ4GA/W8, MSEE, 718 Plum Street, Miamisburg, Ohio 45342. HF antennas, AM, SSB, novice gear, semiconductors.

Roger Taylor K9ALD, BSEE, 2811 West Williams, Champaign, Illinois 61820. Antennas, transistors, general.

Michael Burns Jr. K9KOI, 700 East Virginia Avenue, Peoria, Illinois 61603. AM, SSB, receivers, transmitters, digital techniques, novice help, general.

Jim Jindrick WA9QYC, 801 Florence Avenue, Racine, Wisconsin 53402. Novice transmitters and receivers, general.

John Perhay WAØDGW/WAØRVE, RR #4, Owatonna, Minnesota 55060. AM, SSB, novice transmitters and receivers, HF receivers, VHF converters, semiconductors, mobile, product data, general. Has access to full specifications on almost all standard components presently catalogued by American manufacturers.

David D. Felt WAØEYE, television engineer, 4406 Center Street, Omaha, Nebraska 68105. Integrated circuits, transistors, SCR's, audio and rf amplifiers, test equipment, television, AM, SSB, digital techniques, product data, surplus, general.

Tom Goez KØGFM, Hq Co USAAMAC, Avionics Division, APO New York, New York 09028. HF antennas, mobile, airborne communications equipment, particularly Collins and Bendix gear, AM, FM or SSB–HF, VHF, UHF, general.

Robert Scott, 3147 East Road, Grand Junction, Colorado 81501. Basic electronics, measurements.

PFC Grady Sexton Jr. RA11461755, WA1GTT/DL4, Helmstedt Spt. Detachment, APO New York 09742. Help with current military gear, information from government Technical Manuals.

PFC William A. Youdelman DL4FK/WA6LRS, DSMA B-4, c/o HHB, 6 Bn, 61 Aty, APO New York, New York 09225. Invites questions from members of US Forces in Europe regarding licensing or any technical questions they care to ask.

Eduardo Noguera M. HK1NL, EE, RE, Post Office Box Aereo 774, Barranquilla, Columbia, South America. Antennas, transmission lines, vast experience in tropical radio communications and maintenance, HF antennas, AM, transmitters and receivers, VHF antennas, test equipment and general amateur problems. Can answer questions in Spanish or English. ■

NEW PRODUCTS

Knight-Kit KG-664 Regulated DC Supply

This new supply from Allied Radio is a versatile B+/filament/dc bias supply that fills the need for the multiple voltages required in circuit experimentation and troubleshooting. It is an excellent supply for the amateur since it delivers 0-400 Vdc (regulated) up to 200 mA continuous; 0-100 Vdc at 1 mA (regulated for line variations); plus 6.3 Vac at 6 amps and 12.6 Vac at 3 amps for filaments. The high-voltage output provides a capacity of 80 watts. The voltage and current of the dc supply is continuously monitored by two meters on the front panel.

The specially designed circuitry of the KG-664 permits less than one percent variation in output voltage from no load to full-rated load. Input regulation allows less than one percent variation for ±10 volts variation at 120 Vac input. The advanced circuitry used in this supply is a hybrid design using both tubes and semiconductors for dependable long-term performance; output impedance is less than ten ohms.

Ten isolated five-way binding posts on the front panel offer maximum versatility in ground polarity connections. A heavy-duty operate/standby switch is included for maximum safety while making connection to the load. The KG-664 also features a rear chassis binding post for fast, easy grounding; a detachable ac line cord; and a well-ventilated metal case. Priced at $94.50 in kit form or $140.00 fully assembled. For more information, write to Allied Radio Corporation, 100 N. Western Avenue, Chicago, Illinois 60680.

Economical Motorola Zener Diodes

A new series of ½-watt Surmetic "20" zener diodes from Motorola cover a zener voltage span from 2.4 to 200 volts. The 1N5221-81 devices, although rated at ½ watt with normal mounting conditions, have demonstrated excellent failure resistance when overstressed in 1-watt tests. All units have a 10-watt surge rating and devices above 14 volts have a leakage current typically less than 100 nanoamperes. or further information and data sheets, write to Technical Information Center, Motorola Semiconductor Products, Inc., Box 955, Phoenix, Arizona 85001.

New Callbook Feature

For the first time the United States edition of the *Radio Amateur Callbook* will include the license class identification of licensed radio amateurs listed. This new feature will appear in the form of the first letter of the individuals license class and will follow immediately after the call letters. Identification of the class code will be listed at the beginning of each district. This information will appear for the 48 states only; Alaska, Hawaii and U.S. Possessions will follow in a later issue.

Hallicrafters S-240 Receiver

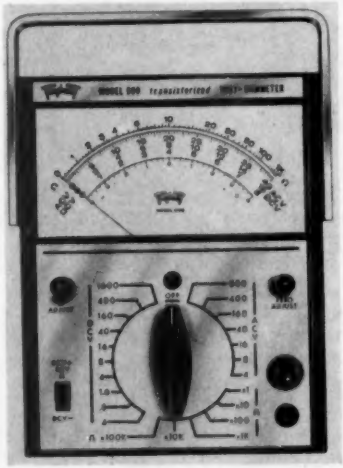
The new Hallicrafters S-240 is a low-cost, all-transistor receiver which doubles as an FM table radio. The standard communications-type features of the S-240 include an rf amplifier on FM for high sensitivity, selectivity and image rejection; a BFO for CW work; main and fine tuning controls for short-wave reception; an S-meter; a slide-rule dial; and automatic gain control circuitry. The S-240 covers the AM broadcast band, the 88 to 108 MHz FM band and the shortwave bands from 2 to 30 MHz. The short-wave bands are covered in three sections: 2 to 5 MHz, 4.5 to 11.5 MHz and 11 to 30 MHz.

The 11 transistor, 6 diode superheterodyne

circuit of the S-240 provides stable and drift-free operation as many tube-type receivers costing several times more. Sensitivity on FM is excellent and its 10.7 *if* bandwidth is 120 to 185 kHz. Combined with a +400 kHz AFC circuit, this selectivity makes FM tuning easy and constant readjustment unnecessary.

Priced at $109.95, more information on the new S-240 is available from your dealer, or write to Hallicrafters Company, 5th and Kostner Avenues, Chicago, Illinois 60624.

Triplett Transistorized Volt-Ohmmeter



The Triplett Electrical Instrument Company has just introduced a new, lightweight transistorized volt-ohmmeter (TVO), the model 600, which has the portability of a VOM with the high input impedance (11 megohm) of a VTVM. It provides a frequency range from 15 Hz to 2 MHz and measures dc voltage, resistance and ac rms values with an accuracy of ±3% on both ac and dc at 77° F.

The Triplett model 600 is designed with a transistorized amplifier consisting of a special field effect transistor circuit to obtain an 11-megohm input impedance and improved stability over battery life and temperature changes. Typical battery life in the TVO is 4000 hours in normal use, which approximates shelf life.

The model 600 has an entirely new case design which uses a brushed aluminum front panel with etched black range markings. All meter controls are clearly marked on the aluminum panel, and the single selec-

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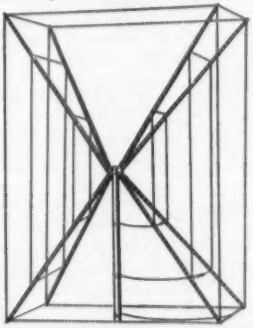

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tor switch controls all ranges and functions. One small, compact probe is used for dc, ac and ohms. The probe has a built-in sliding switch which places a resistor in series with the instrument for dc voltage readings.

The meter has been made easy to read by the addition of color to the various ranges and combining the ac and dc voltage readings. Other features of the model 600 include direct reading measurements for FM discriminator lineup, and a dc polarity reversing switch. $78.00 from your dealer, or write to Triplett Electrical Instrument Company, Bluffton, Ohio 45817.

Personalized Door Mat

Amateurs who are looking for the unusual, and a new and interesting way to show their call letters might look into the new floor and door mat available from Herbert Salch & Company. These mats, 18 by 28 inches, are made of durable high-quality rubber with rubber fingers that automatically clean in a self-draining style. Available in black, brown, green and blue with your name and call in large white 2½ inch letters across the middle. Limited to 13 letters. $7.95, postpaid, from Herbert Salch and Company, Woodsboro MPR, Texas 78393.

Winco Alternators

Two new series of Winco power alternators for portable and standby electric power have been announced by Wincharger Corporation, a subsidiary of Zenith Ratio. The new heavy-duty alternators provide 2500 watts ac, 60 Hz, and operate at 1800 rpm. The only difference between the two series is the driving power—the 205BS uses a Briggs & Stratton engine, the 205WS, a Wisconsin engine. Both engines are of cast iron construction with Stellite valves and valve rotators for long life at 1800 rpm.

These heavy-duty Winco alternators will safely power a one-horsepower motor, plus a 400-watt resistive load and are ideal emergency power plants. They are available in manual, electric and remote start, in both single and dual voltages. Optional equipment includes a carrying handle, a carry-

ing cradle, or two-wheel dolly mounting. Both series also permit a choice of fuels: gasoline, propane, or natural gas. For complete details and prices, write to Wincharger Corporation, 1805 Zenith Drive, Sioux City, Iowa 51102.

Jensen Electronic Tool Kit

A new, deluxe tool kit for electronic technicians has been introduced by Jensen Tools. This new 75-piece kit, designated the JTK-5, includes all of the tools normally required in building breadboards and prototypes of sophisticated electronic equipment.

The inclusion of basic metal-working tools in the kit permits the experimenter to construct a wide variety of electronic assemblies requiring panel and chassis work. Each kit includes files, a scribe, precision knife, wire bending pliers, diagonal cutters, slip-joint pliers, scissors, screwdrivers, slide caliper, soldering iron and solder, soldering aids, tweezers, wire stripper, adjustable wrench, hex and spine-key wrench sets, ¾-inch electric drill, drill case with drills, chassis punches, ball pein hammer, center punch, hacksaw, taps, reamer and electronic alignment tools. "The kit comes complete with a steel toolbox and tray. A catalog describing this tool kit may be obtained by writing to Jensen Tools, 3630 E. Indian School Road, Phoenix, Arizona 85018.

Maestro Receiver Booster

If you're looking for a way of increasing the sensitivity of your receiver on ten meters, the new Maestro Booster from Wawasee Electronics may be just what you're looking for. This unit, although designed for CB equipment, performs nicely in the 28 MHz amateur band. It requires no wiring into the receiver, has a built-in antenna switching relay and requires no tuning or adjustments. The use of a 7788 vacuum tube with 10,000 hours life (equivalent to five years operation) results in 3 to 5 S-units of receiver boost. $64.50 from Wawasee Electronics Company, Post Office box 36, Syracuse, Indiana 46567.

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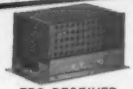
Narrow-band system operates up to 100 ft. Keep RECEIVER in garage, TRANSMITTER in glove compartment. Made of finest, handwired components. Approved by FCC. Order today! If not satisfied, return in 10 days for full refund.



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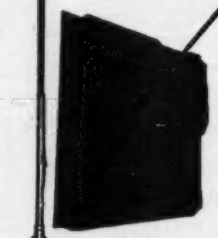

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Electronic Engineering Measurements Filebook

Although many of the measuring techniques covered in this new book from TAB Books are not particularly adaptable to the amateur workshop, they are very useful to the amateur who is a technician or engineer in industry. Many of the "measurements" texts cover only the generalities of various tests and measurements, but the "Electronic Engineering Measurements Filebook" is a collection of detailed techniques, complete with specific test setups, waveforms, and analysis of how to measure specific parameters.

Each of the techniques described includes data on the test equipment and/or circuitry required, test procedure, interpretation of the results and special considerations and pitfalls, if any. The most interesting feature of this book is that the techniques it describes covers measurements that cannot be made using the usual procedures. Items that are especially useful to the amateur include measuring noise with a VTVM, measuring f_T of a transistor, measuring transistor small-signal hybrid parameters, measuring transistor h_{fe} at 100 MHz, measuring Y-parameters of field effect transistors, and how to select the right probe. In most instances the techniques described can be readily modified and adapted to suit the reader's specific needs. $9.95 from TAB Books, Drawer D, 18 Frederick Road, Thurmont, Maryland 21788.

James Millen Catalog

The James Millen Company's new components catalog lists all kinds of goodies for the ham. A complete line is available, including tube sockets, flexible couplings, plate caps, safety terminals, terminal strips, dial locks, miniature inductors, rf chokes, air-wound transmitting inductors, transmitting and tuning capacitors and many other items. There is also a set of miniature components, plus high-voltage rf switches, panel dials and *if* transformers. In addition to the components listed in this catalog, James Millen manufactures grid dip meters, amateur radio equipment, module oscilloscopes, magnetic shields and delay lines. For your personal copy of their new components catalog, write to James Millen Company, 150 Exchange Street, Malden, Massachusetts.

Selected Electronic Circuitry

If you're looking for a novel circuit to do a special job, NASA's "Selected Electronic Circuitry" may have it. This new book from the Government Printing Office has chapters on amplifiers, oscillators, multivibrators, power supplies and related circuits, wave shaping circuits, temperature compensation circuits, control circuits and computer circuits, plus a glossary of terms. In selecting the circuits for this book, NASA made an effort to include novel circuitry that is of interest not only to the professional engineer, but to the electronics hobbyist as well. If you can't use any of the 78 circuits directly, they will give you some interesting ideas. A must at 70¢ from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Order NASA SP-5046.

Solid-State Power Control Circuits Library

A new applications oriented, power control circuits guide compiled from a series of application notes written by Motorola semiconductor engineers is now available. "Solid-State Power Control Circuit Library" presents new and useful solutions to many common thyristor control problems. Topics included in this 70-page book are SCR power control fundamentals, trigger circuits, suppressing rf interference, high torque motor speed control and reducing SCR failures. Free copies of this handy new book may be obtained by writing on your company letterhead to Motorola Semiconductors Products, P. O. Box 995, Phoenix, Arizona 85001.

TUCO Catalog

If you are having trouble finding a special semiconductor for that new project, you should have a copy of the new catalog from Transistors Unlimited Company. In addition to a complete selection of semiconductors from the major manufacturers, TUCO carries integrated circuits from Fairchild, GE, Philco, Motorola, and Amperex. Furthermore, they carry the complete line of Amperex manufactured audio amplifiers from one to twenty watts. TUCO also lists their miniature electrolytic capacitors, variable capacitors, coils and chokes, resistors, transformers, switches, pots, heat sinks and other useful items for the experimenter in catalog 5A. For your copy, write to Transistors Unlimited Company, 462 Jericho Turnpike, Mineola, L.I., New York 11501.

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SPECIFICATIONS:

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- Advanced circuitry utilizing 35 semi-conductors most of which are silicon.
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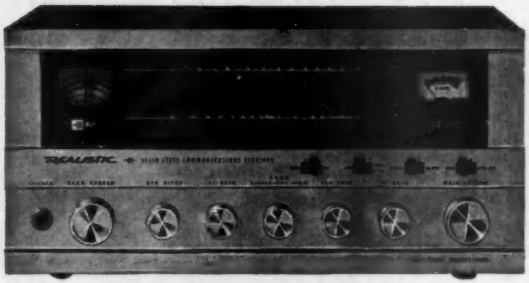

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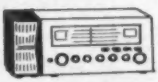

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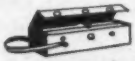

12VDC portable pack with all cables, plugs, 8-long-life batteries; includes plug-to-plug and plug-to-lighter cord sets. 20-1501: Only $7.95 (wt. 4 lbs. w/batteries)

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* *Plus Shipping Cost: 14 lbs., 4 lbs., 4 lbs.*

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Letters

CB'ers, Novices, and all that Jazz

Dear 73,

A short, though pointed, dissertation upon your July editorial, if I may.

First, although I try to keep abreast of developments in hamdom, and regularly purchase most of the magazines in the field, I am not myself an amateur. This is not due to lack of ability—I could pass the test tomorrow with no difficulty. My choice was based upon a lot of consideration and thought.

. . . It is my own personal observation that the Citizen's band has done more to afford hamdom new members than you realize . . . I can point out a dozen in my area who have forsaken CB for the ham bands, if for no other reason than to be able to talk without incessant "break-break-break" from some loud-mouthed moron whose brains are wired to switch off when he hits the mike button.

Granted, initially, CB holds a sort of appeal to a newcomer to radio . . . plunk down $8, shell out a few more bills for a full-house peanut-power transceiver, and presto—instant radio. For a while it is the greatest thing since puberty. However as time progresses, and one gets to know the type of clowns who share these bands, he gets an itching to go somewhere where the people are a shade more sane, and considerably more intelligent.

I think it is well to look elsewhere for the source of the apathy which is running amateur radio down the ramp behind the dinosaurs and the dodos.

I would offer this possibility. That ham radio has simply lost all it's glamour, as I believe you pointed out. There was a day when to be a ham, one spent long hours burning the midnight lights, sweating over a hot soldering iron, cussing an occasional scorched thumb, and laboriously piecing together a home-brew monster that, with a healthy dose of miracle working, might possibly work.

Today the ham is a new breed. He memorizes the code, bones up on the theory, and lays out a wad of the long green for a room full of prewired, pretested, guaranteed-to-work-or-your-money-back, appliances with their aesthetic chromium baubles and pretty lights.

Frankly, ham radio has been overwhelmed by science. I do believe that, as you noted, more good PR will alleviate this apathy somewhat, and the news of a ham rig on the moon will draw a lot of fence riders into the pasture. Howevermuch, we have another question . . . why does hamdom need more hams?

Evidently, there are too many hams on the air already, without adding to the confusion. You may well point out the huge silence which envelopes the VHF bands, and I fully agree. But it is one thing to promote them and quite another to get John Q. Ham to go up there and clear out the lower bands. VHF is the playground of the elite amateur who is well up on his theory and who can do more than twiddle knobs and call CQ.

So there the situation stands—a few hearty souls up on the high end and all the other 99.5% crammed like sardines into 80 thru 10, fighting tooth and nail for a few unmolested kHz on which to carry a QSO.

What we need is not more amateurs, but more HAMS of the old school who don't rely on their wallet, and who aren't afraid to try something new and different.

This is one major reason I am avoiding becoming a ham myself. There is no one around here on VHF and I'll be damned if I'm going to get into that rat-race on the dc bands. I'm going to just stand back and watch, as hamdom strangles itself to death, because nobody has the brains to get out and go up, and the low bands will gradually turn into mass confusion.

As I see it now, more amateurs will kill ham radio, rather than cure it.

If you can present a convincing enough case, I'll go for the ticket and join the hysteria. I don't suppose that one more carrier will matter that much . . . will it?

Bob Renaud
Washington, Mass. 20123

Now if we could get a few more hardy souls to try 432 and 1296 in northern New England . . .

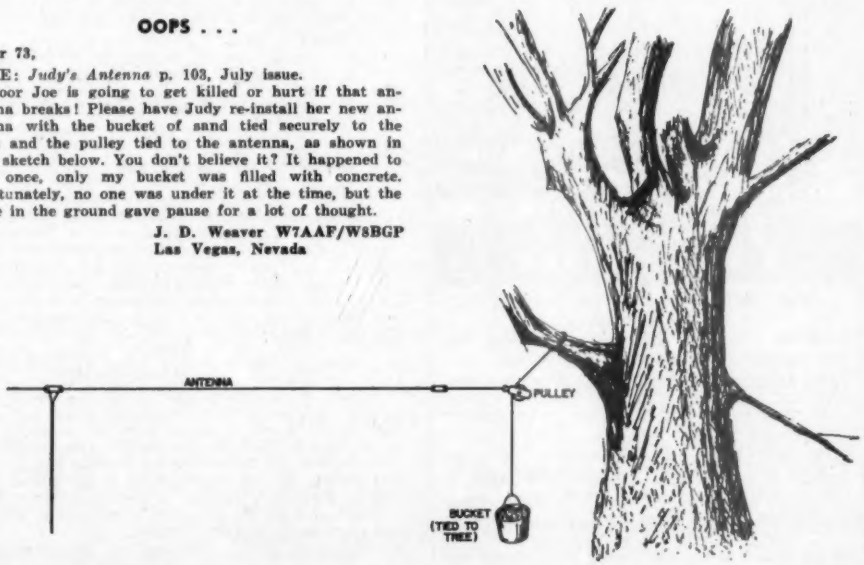
OOPS . . .

Dear 73,

RE: *Judy's Antenna* p. 103, July issue.

Poor Joe is going to get killed or hurt if that antenna breaks! Please have Judy re-install her new antenna with the bucket of sand tied securely to the tree and the pulley tied to the antenna, as shown in the sketch below. You don't believe it? It happened to me once, only my bucket was filled with concrete. Fortunately, no one was under it at the time, but the hole in the ground gave pause for a lot of thought.

J. D. Weaver W7AAF/W8BGP
Las Vegas, Nevada



HW12, 22, 32 OWNER

(applies to "A" series, also)

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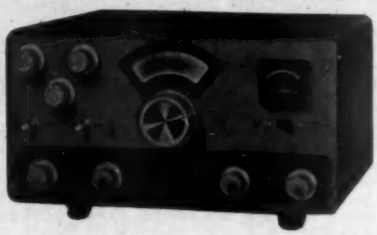

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Dear 73,

I disagree with W1DTY's editorial (August *73*). Permitting phone operation on ten meters would certainly make the Novice license more attractive to the non-ham (and CB'er). But, it would reduce the motivation a Novice has to operate CW, and thereby increase his CW proficiency to 13 WPM. Extending the term of the license to two or more years would probably help very little. Many Novices would spend their first year or so CB'ing it up on ten phone, forgetting what little CW they had to learn to pass the 5 WPM novice test.

As for the argument that the proposal would allow the Novice to "see what amateur radio is really like", I suggest that the Novice use his receiver for this purpose. If he finds HF phone operation appealing, well, that's another reason to hurry up and get his General. Anyway, I doubt that a 200 kHz segment of ten meters, far from the General-class action, would be much of an education. The Novices would only have each other to talk to, and they might pick up some bad habits from the ex-CB'ers amongst them.

One more gripe: Wayne's ideas about Vietnam, be they good or bad, do not belong in *73*. He should know that.

Vic Rosenthal K2VCO/3
Pittsburgh, Pa.

Dear 73,

I am very much disturbed with the idea of the FCC granting possibly "A Radical Proposal" to the would-be amateurs, "CB's". I feel that I am in a position to express my truthful opinion, because I once held the call 1W9296, and therefore would be classed an "OM" on the Citizens Band.

I feel that obtaining an amateur ticket is an accomplishment in it's self, due to the fact that you can not simply fill in an application and expect to receive a call sign. You must do some work on your own. The only persons who want this proposal are the typical "C.B. Lids". Why should we give them some of our frequencies to use improper operating procedure on, etc. Let them study and obtain their licenses like all of us had to. We amateurs would be more than happy to help them out to get on the air, I'm sure. But, not by changing the license exam.

I'm sure that once you obtained your license, you had the feeling of a job well done, so let's keep our proud name and by all means let's keep the amateur code and theory exam.

Grady L. Sexton, Jr. WA1GTT/DLØ
Berlin Brigade APO 09742

Oops, wrong magazine Grady. I think the radical article was in CQ!

More AM/SSB

Dear 73,

Congratulations on your article in June 73 concerning AM vs SSB. In this day of crowded frequencies, should we tolerate a mode of transmission that uses twice the band width necessary for communications? . . . I would like to suggest no AM operation in the 3.5, 7, and 14 MHz bands. In the 21 MHz band, no AM above 21.300 MHz, and in the 28 MHz band, no AM below 29.000 MHz.

Henry R. Pemberton W3PN
Wayne, Pa. 19087

Dear 73,

. . . Overall, 73 is great—but with one horrible deficiency: you are bowing to Big Buddha QST's lordly dictum that there is no such thing as AM phone.

Why ignore a significant group of amateurs who thoroughly abhor the crude methods by which SSB is being jammed down their throats?

John M. Murray W1BNN
Bloomfield, Conn.

Dear 73,

Recently there has been much controversy about the use of AM on the 20-meter band. Amateurs using AM claim that their right to operate in the "AM" portion of the band was established in a long-standing gentlemen's agreement. It is just coincidental that this AM portion is the segment of the band in which the majority of DX work is done.

. . . I operate Sideband and I am not what one would call a "big gun" and thus, my voice is not well known on the air. However . . . it becomes particularly annoying to me when the local AM'er comes on and hetrodynes the station I am talking to out of existence.

I am not condemning AM as a mode . . . I am suggesting that a new Gentleman's Agreement be made, in which AM operation be confined to a different segment of the phone band. 14250-14300 kHz seems to be the likely choice. This allows ample room for operating and leaves the lower 50 kHz of the phone band free for serious DX work.

D. Christopher Ohly WB2YOA
Brooklyn, N.Y.

Dear 73,

. . . In banning AM you are essentially banning the new builder. In taking the steps from Novice to General, a builder type must stop at AM to learn what *isn't* in the license manual or beginner's radio books . . . AM equipment is relatively easy for the beginner to make.

I am not sure whether your remarks on the ease with which DSB can be built is correct or not. There is no up-to-date literature on it that I can find. Articles refer either to a 1953 *73* or a 1647 *QST* issue. They're not easy to find.

Charles L. Hyser WA3GXM
Strafford,—Wayne, Pa.

Try July 1967 *issue of* 73, *page* 10.

Dear 73,

Yes! I am thru with 73 magasine for a very good reason and it is your own fault. When you decided ham radio was only for Slop Bucket and not for AM you let me out. Your last editorial (June) tore it for me. I am recommending by letter and by air that my hundreds of friends also send the five bucks to hAM International instead of renewing 73. So, get ur subs from the SB boys.

P. F. Hadlock K2IK
Hammond, New York

I'll bet you said just about the same thing when they made you get off spark.

Bouquets and such

Dear 73,

Just finished the July issue of *73* and I must say you have paid a wonderful tribute to our Canadian neighbors. The article about the Maritime Mobile stations was excellent.

I agree with the editor's views wholeheartedly. CB has had an unfortunate influence on young people. It is too easy to get a license in the first place, and, in too many cases the adults using the band do not set a good example.

Also wanted to congratulate you on the series on getting a Novice license . . . it will surely be of great help to many.

Anne Lefler WA1ELV
Mansfield, Mass.

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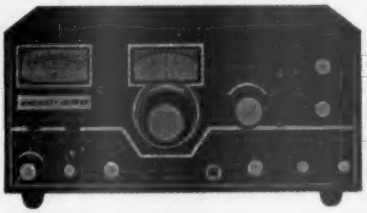

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Dear 73,

Congratulations on your new Editor. He is doing a fine job, and has rekindled in me a new enthusiasm for your remarkable magazine.

I am also pleased to see a more humble and more constructive W2NSD/1. His new attitude of working to improve ARRL operations, rather than destroy them, makes sense. And in his disillusionment with DX Expeditions, I even detect a relenting attitude on the desirability of QRP operation. QRP operation will improve the state of the art. The argument that more people should use high power to demonstrate the presence of radio amateurs on the bands is absurd, as ten minutes of listening to them will verify.

Now just a word about the letters in your May, 1967 issue. For further information about anti-gravity projects, WA6DZL might contact WØNL, who publishes *Auto-Call*. I should like to disagree with WA9OHS, because I find the new binding of *73* is excellent, and the magazine stays open just fine if you crease it at the margin. My one argument with your format is the practice of distributing advertisements throughout the magazine. This makes it impossible to tear them out to reduce the volume on the bookshelf. The problem is that too many of your articles are worth saving.

Thanks for not splitting up articles in bits continued at the back of the magazine. It makes them easier to file separately for reference material. The main problem comes when two good articles on different subjects come together. Could you please alternate good articles with irrelevant filler? Hi.

R. L. Gunther VK7RG
Sandy Bay, Tasmania, Australia

Dear 73,

The excellent manner in which you handled the W2USA story is deeply appreciated by me! Yesterday there were two regular "on-the-air" meetings of Florida groups. Some very complimentary things were said. Many nice things were said about your editorial, with nary a word counter.

Arthur H. Lynch W4DKJ
Fort Myers, Florida

Dear 73,

Will you please send me a copy of the marvelous editorial written by you in the July *73*. I think it is perfect. It puts the case on the table. I want to reproduce it and give it to our club members. Keep up the good work Jim Fisk W1DTY.

Eugene W. Sickles WA5DMT
Fort Smith, Arkansas

Dear 73,

The August issue of *73* arrived yesterday . . . getting bigger and better every month. Congratulations.

I read your editorial as soon as I opened the mag. (I always do). On page 2, you made the statement, *'even the best five band transceiver does not cover the entire 28 MHz band!'* Now, Jim, I realize that my Swan 500 is one of the best, and I have been under the impression that I *could* work the entire 10 meter band. I hope the FCC knows about those bootleggers I have been talking to up there, hi.

We were under the impression that one of the proposals the FCC acted upon last year was to disallow the same "two year for novices" that you spoke about. Personally I am all for it.

Bill Moss WA8AXF
Petoskey, Mich.

Sorry about that!

THE SWAN 250 A VHF SUCCESS STORY

In the limited field of Amateur Radio we seldom see early evidence of a stunning success. The so-called classics usually take several years to develop.

Swan's six meter side band transceiver is a classic now, scarcely 12 months from the date of its first commercial release. This is all the more remarkable because of the smaller number of hams occupying six meters, as compared with the lower bands, and startling, too, because there are so many neophytes on six meters holding technician licenses who apparently have not been afraid to modernize, or to start in with side band equipment.

The 250 is now owned by several thousand hams, who have found 6 meters a relatively QRM-free band. Typical QSO's range from several hundred miles on ground wave to double skip across the continent. Bear in mind that extremely simple and inexpensive beams, easily erected and rotated, provide a gain of over 10db, and require ever so little space.

But price has a great deal to do with the Swan's popularity. The combination of moderate power (240 watts PEP), excellent stability, and sound design without frills, has enabled the 250 to be priced at only $325.00. When you compare it with brand X's kit, and brand Y's 20-watt rating, there really isn't any comparison. Swan wins hands down. Standard Swan supplies for AC or DC operation are readily available. For example, the AC unit with cabinet and speaker (Model 117XC) costs but $95.00. The complete 12 volt DC package costs but $130.00. What's more, if you already own the low frequency Swan transceiver, such as the 350, or the 400 or the new 500, then the same power supply that you now have will power the Swan 250. Another feature is the optionally available Model 14X, which for $65.00 will enable owners of the 117XC or the 117XB power supply to convert to 12 volt DC operation. Adding the supply, $95.00, to the transceiver, $325.00, the result is only $420.00. No wonder the **other** manufacturer's have had to reduce price.

The Model 250 covers the whole 6 meter band, including MARS frequencies, as well. It is very easy to tune up, yet even easier to operate. And of course it sounds good, too! (don't all Swans?).

The high order of stability of the 250 didn't come easy, and side band reception is a simple way to show up drift. Swan uses a 13 megacycle transistorized oscillator and tripler combination, which is amplified by a 6EW6, then mixed with a 10.7 megacycle carrier in a 7360 balanced modulator, to result in output on 50 megacycles. Two 6146B's, conservatively operated, provide long linear tube life, with a high order of efficiency.

Some of our customers are very knowledgeable about receiver front ends. They will be pleased to know that two 6HA5 frame grid triodes are used up front with better than a 3 db noise figure over the entire band. The band pass is 2800 cycles on both receive and transmit. Like the lower bands, only one side band is arbitrarily used by most all hams; here on 6 meters the upper side band is chosen.

Antennawise, if you want to match 300 ohms, or an open line, or, more likely, the common 50 ohm coax, you'll be pleased to learn that the Swan 250's pi tunes from about 30 ohms to almost 1000 ohms.

Oh, and I forgot to mention, unwanted products are down at least 40 db; the carrier is down at least 50 db.

For you mobile buffs, the 250 has a built-in noise limiter, which helps a great deal, and if you will accept some more advise, try using RG8 foam cable, instead of RG58, and then running this, the entire length of it, inside a piece of soft drawn copper tubing, which you can install in the frame of your car. Extend this appropriately to within inches of the SO239 on the rear of the 250, and similarly to the mobile antenna. Then bond the tailpipe, the engine, and everything else including the sheath of the coax at each end, to the copper tubing. As if by magic, your ignition noise will almost disappear. Another must is to use at least No. 8 wire from your battery, or starter terminal to the DC supply. If possible, connect a thru line filter on the fire wall of your car, then run the line from your battery to the accessory switch through this filter. This will enable you to keep the impulse noise out of the filaments of the 250. If you do these various things, you will have the quietest installation possible.

Side band mobile on six, especially in the heavily populated metropolitan areas, is the perfect antidote for you Caspar Milquetoasts, who haven't learned your TVI diplomacy. While field days, picnics, or mountain topping are obviously perfect excuses for the 250, the more professional VHF'er will be equally rewarded from his fixed location.

Don't forget that at 2.5 to 1 VSWR, 10% of the forward power is reflected back into the transmitter, imposing an additional burden on the final. So please try to adjust your operating frequency to the resonant frequency of your driven element.

Getting back to the Swan—we do sell a lot of these 250's, and all of the other Swan models as well. We naturally have to stock heavily, and we want your business—so we'll try to give you a good deal on your trade-ins, but remember, we have never discounted and don't expect to start now.

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Dear 73,

No Sir! Don't stop my magazine, gotta have it every month.

I've been wanting to write you about 73. It's a real good educational, helpful, and inspiring magazine. Beats all the others to heck. Those transistors look simple, the way they are connected. Other magazines show complicated hook-ups. I've been a "tube man" for 20 years, but not anymore . . . keep up the good work.

Leroy Lawmaster W5HOM
Watts, Oklahoma

Dear 73,

This is a brief letter of thanks. It is good to have an alternative to ARRL's Messiah complex and CQ's ho-hum attitudes. Please stay as refreshing and vital as you are now.

It takes daring for a special interest group publication to devote almost an entire number to a single topic, such as your treatment of Quads in May; however, I predict that issue will be nearly a reference work on all the aspects of them.

. . . The way to keep ham radio progressive, and to insure it a place in the spectrum in days ahead is not to bewail how backward we all are in editorials, and then devote the remainder of an issue to 75-meter sideband, as QST does each month. The way any ham magazine can help keep ham radio up to the "state of the art" is to do what you are doing. Publish thought articles as well as nut and bolt descriptions. In line with all this, I will volunteer for the Technical Aid Group.

William J. Barrett K1VVQ
Old Greenwich, Conn.

Dear 73,

Regarding July *73*, p. 33, is a display of QSL cards received by W2USA at the 1939 World's Fair. You said it would be interesting to know if anyone had a duplicate of any of the cards. Third row from right, seventh card down is W8SCW. My card is dated 3-8-'39. Also, ninth row from left, 8th card down is W8SKQ. My card is dated November 14, 1938 and is for a 40 meter CW QSO. I also have another duplicate of this card dated 1-31-61 for a 40 meter phone QSO. How about that. 22 years apart and we exchanged same old QSL cards.

Would be interested in seeing more articles about the good old days.

Louis Pastor W8SLF
Barberton, Ohio

Look for the article on pioneer DX in this issue.

Dear 73,

I read with interest in July issue of *73* letters "The Fabulous Drone" by Mr. Nick Basura of Los Angeles, Cal., so I'll ask him to move over as he has more company. I thought to be alone in these thoughts and was afraid to express them. When Thomas Edison's birthday comes, the local radio station gives him quite a build up and credits him with just about everything in electricity. Did you know that Nikola Testa discovered ac current? Dumping the generator, transformer and motor on George Westinghouse's desk for which he received $1 million . . . He died in New York in 1934 with 8¢ in his pocket! What happened to the million dollars? He put most of it into his experiments. Were he a business man, the flyback in TV receivers would carry his name. Thomas Edison was a business man, while Nikola Testa was an 'inventor. In hopes Testa receives some credit on his birthday . . .

Joseph E. Vucco W8HCL
Warren, Ohio

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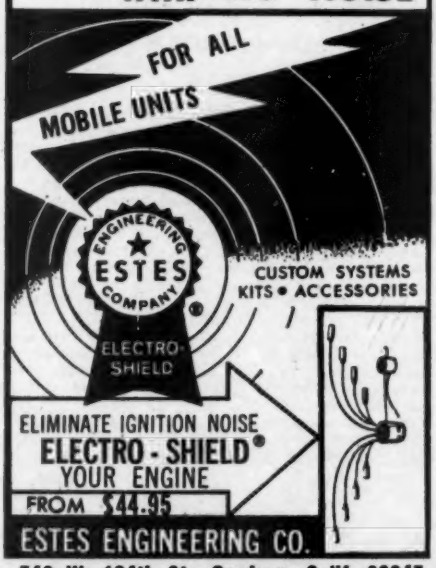

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FM

Dear 73,

FM amateur activity is growing exponentially in the U.S. in spite of the tendency of ham magazines to pretend it doesn't exist.

How much longer are the major journals going to ignore FM as a standard mode of communication for amateur radio operators? . . . Today, there are thousands (and this is no exaggeration) of active amateurs operating on deeply entrenched FM channels on two and six meters across the country.

I speak for us all, I'm sure, when I say that we'd like to see some promoting of our favorite mode of operation in the major amateur magazines. We would all like to see a monthly column devoted to FM operation.

. . . Even *Electronics Illustrated* carried a full-length feature article (July 67) about FM activity on two and six meters. FM activity is now so universally accepted that one can read about it almost anywhere.

Anywhere, that is, except in the ham journals.

Ken W. Sessions, Jr. K6MVH
Ontario, California

Radio Parts to India

Dear 73:

I am taking the liberty of enclosing a copy of a letter I have received from Girish VU2HGZ, which I thought might be of interest to you.

. . . I have become convinced that if we wait for the ARRL or any other organization to do something to help advance amateur radio in India, it may be too late in many instances to take advantage of the opportunity which exists.

I wish there was some way in which parts and simple equipment could be sent to those fellows who are in such great need of it. It hurts to have Girish ask for low-power transmitting tubes, GDO's, components, etc. which U.S. amateurs have lying around their shacks.

Morgan W. Godwin W4WFL/WA2WOR
New York, New York

Excerpts from VU2HGZ's letter follow:

My Dear Morgan Godwin,

It was with the greatest pleasure that I received your letter. I was very pleased to read the *73* editorial regarding hams in India and other developing countries in the world. He is quite right in suggesting that we do not need very sophisticated equipment . . . what we need is a lot of technical literature and also lots of components in reasonably usable condition.

. . . I am Secretary of the Gujarat Amateur Radio Society. Today we have about 20 licensed members in the club, with about 30 more coming up. But we have totally run out of parts and so are in the doldrums.

. . . Some of the members of the club are VU2MQ, VU2MVZ, VU2CC, VU2PWZ, VU2PXZ, VU2UD, VU2RE, and VU2HD. Small gifts sent individually, and in small packets, can be received by us with no formality. We also need some valves (6146), etc., phase shift networks, grid dip meters, and cathode ray tubes, etc.

The club meets thrice a week in a small shack with VU2GC as a club station where we also take regular free Morse Code classes and guide everybody.

Girish H. Shah VU2HGZ
Maternity and Nursing Home
Relief Road
Ahmedabad, India

How about looking in your junk boxes and helping these fellows out? If you send small packages, there shouldn't be any trouble with customs.

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5 A	.90	1.40	1.75	2.25	2.60

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800	.40	1.25	1.50	2.30
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400	1.20	1.60	2.10
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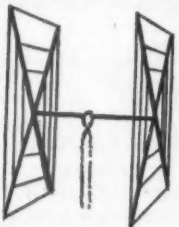

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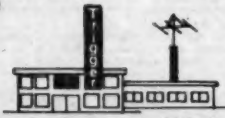

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WANTED: January and March, 1961, issues of 73 Magazine for my personal collection. S. B. Young, WØCO, Rural Route 3, Box 94, Wayzata, Minnnesota 55391.

TELEVISION CAMERAS: 2 RCA TH-10 heads with I.O.'s, video DA's, Processors, Color monitor TM 10, TM 21. Make offer, or inquiry. Harold L. Harrington, 908 W. Beaver Ave., State College, Penna. 16801.

SWAN 350, one month new, in mint condition, $360; Swan 14-117 AC/DC Power Supply, with cables, $75, or both units for $420. 18AVQ antenna for $25. All FOB Los Angeles. Selling out. Send certified check or money order to Alan Snowden, K6YPB, 22740 Clarendon St., Woodland Hills, Calif. 91364.

CANADIANS: EICO 753 transceiver, 751 P/S, one year old, $375. McCoy 48B1 9-Mc xtal filter unused, $35. VE2DDH, Box 1116, Senneterre, PQ.

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HOMEBREW LINEAR with 4 811-A's, TR switch, filter and nine 811-A's, for $75. Ship collect. Dave Gould, 5600 Sly Park Rd., Pollock Pines, Calif. 95726.

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SACRIFICE FOR QUICK SALE Swan 240, mint condition, used only 4 hours, original carton. $150. WA4WAO, 1815 Forney Drive NW, Huntsville, Ala. 35805.

MARYLAND 2-METER TERMITE NET CONTEST begins 2100 GMT October 21, runs 24 hours. For contest rules, etc., write the club at Box 153, Linthicum Heights, Maryland 21090.

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THE NEW MAINLINER TT/L-2 appears in September RTTY Journal. Do you subscribe? $3 per year in U.S. & Canada. P.O. Box 837, Royal Oak, Mich. 48073.

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HALLICRAFTERS HT-37 $175. SX-101A $175. SX-99 $75. Skyrider Defiant $25. RCA Voltohmist VT-VM $15. Simpson 260 VOM $15. Excellent condition. WØKON/7, Box 473, Sumner, Wash.

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18A/100PIV Pressfit Diodes...5/$1
Toroids Ferrite, Assorted .....2/$1
Solder Multisocs, lb. $1
Microswitch 15A/AC&DC.....8/$1

SCR-SILICON-CONTROL RECTIFIERS!

PRV	7A	25A	PRV	7A	25A
100	Q	$1.10	500	2.50	3.75
200	Q	$1.50	600	3.25	4.25
300	1.80	2.25	700	4.00	5.00
400	2.00	2.90	800	4.75	5.65

SCR 50 PIV/25A 80s@, ...8/$5
SCR 50 PIV/7A 40s@ .....12/$5

2 RCA 2N388 & 2/1N2326 Ckt Bds 1N2326 Can Unsolder .....6/$1

DISCAP .001 Mfd@5KV .....6/$1
DISCAP .01@2KV .....10/$1
DISCAP Assimnt up to 6KV...20 for $1
Bandswth Ceramic 500W 2P/6Pos..$3@
5Hy-400Ma Choke $4@.....2/$5
6Hy-500Ma $5/@ .....2/$6
250Mfd @ 450 WV Lectrlytic 4/SSB $3@
Cndsr Oil 10Mfd/600V, 1/$1, 3/$2, 12/$5
Cndsr Oil 6Mfd/1500V.....1/$2, 6/$10
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10 Vet@5A & 7.5 Vet@ $5@.....2/$9

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Factory Tested & Guaranteed

Piv/Rms 50/35 .05	Piv/Rms 100/70 .07	Piv/Rms 200/140 .10	Piv/Rms 300/210 .12
400/280 .11	600/420 .18	800/560 .25	900/630 .40
1000/700 .50	1100/770 .70	1700/1200 1.20	2400/1680 2.00

*All Tests AC & DC & Fwd & Load!

1700 Piv/1200 Rms@750Ma..10/$10
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D. C. Amps	50Piv 35Rms	100Piv 70Rms	200Piv 140Rms	300Piv 210Rms
3	.10	.15	.22	.33
12	.25	.50	.75	.90
18	.20	.30	.75	1.00
45	.80	1.20	1.40	1.90
160	1.60	2.90	3.50	4.60
240	3.75	4.75	7.75	10.45

D. C. Amps	400Piv 280Rms	600Piv 420Rms	700Piv 490Rms	900Piv 630Rms
3	.40	.50	.60	.85
12	1.20	1.50	1.75	2.50
18	1.50	Query	Query	Query
45	2.25	2.70	3.15	4.00
160	5.75	5.75	Query	Query
240	14.40	19.80	23.40	Query

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DC 2½" Meter/RD/50VDC $5@....2/$5
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Wanted 304TL Tubes Top $$$ Paid
Socket Ceramic 1625 Tube....4/$1, 10/$2
Socket Ceramic 4X150/Loktal .....4/$2
Wanted 304TL-Top $$ Paid!!
2.5MH PiWeund 500 Ma Choke..4 for $1
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Precision TL147 Feeler Relay Gage 2/$1

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W.E. Socket for #255A Relay.....$2.50
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Klixon 5A Reset Ckt Breaker $1@..10/$5
Line Filter 4.5A@115VAC.....5 for $1
Line Filter 8A/@125VAC.....3 for $1
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Helipot Dials ..... each $3.00

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6.3V @ 1A $1.50@.....4 for $5
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.001 to .006 Mica/1200WV Cends ..6/$1

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Cndsr Oil 2Mfd/2KV .....ea/$2, 6/$10
Cndsr Oil 3Mfd/2KV .....ea/$3, 4/$10
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Propagation Chart

OCTOBER 1967

ISSUED AUGUST 5

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EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7A	14	21	21	21
ARGENTINA	21	14	14	14	7	7	14	21A	21A	28	28	28
AUSTRALIA	21	14	14	7B	7B	7B	7B	14	14	14	21	28
CANAL ZONE	14	14	14	14	7	7	21	21	28	28	28	28
ENGLAND	7A	7	7	7	7	14	21	21	21A	21	21	14
HAWAII	21	14	14	7B	7	7	7	7B	14	21	21A	21A
INDIA	7	7B	7B	7B	7B	7B	14	21A	21	14	14	7
JAPAN	14	14	7B	7B	7B	7	7	7	7B	7B	7B	14A
MEXICO	21	14	14	7	7	7	14	21	21	21	21A	21A
PHILIPPINES	14	14	7B	7B	7B	7B	7B	14	14	14	7B	14
PUERTO RICO	14	14	7A	7	7	7	14	21	21	21	21A	21
SOUTH AFRICA	14	14	14	7A	7B	14	21	28	28	28	21A	21
U. S. S. R.	7	7	7	7	7	7B	14	21	21	14	14	14
WEST COAST	21	14	14	7	7	7	7A	14A	21	21A	21A	28

CENTRAL UNITED STATES TO:

ALASKA	21	14	14	7	7	7	7	7	14	21	21	21
ARGENTINA	21	14	14	14	7	7	14	21A	21A	28	28	28
AUSTRALIA	28	21	14	14	14	14	7B	14	14	14	21	28
CANAL ZONE	21	14	14	14	7	7	14	21	28	28	28	28
ENGLAND	7A	7	7	7	7	7B	14	21	21A	21	14	14
HAWAII	21A	21	14	14	7	7	7	7B	14	21A	28	28
INDIA	7	7B	7B	7B	7B	7B	7B	14	14A	14	14	7
JAPAN	21	14	7B	7B	7B	7	7	7	7	7B	14	21
MEXICO	14	7	7	7	7	7	7	14	21	21	21	21
PHILIPPINES	21	14	7B	7B	7B	7B	7	14	14	14	7B	14A
PUERTO RICO	14	14	14	14	7	7	14	21	21	21A	21A	21
SOUTH AFRICA	14	14	14	7A	7B	14	21	21	21A	28	28	21
U. S. S. R.	7	7	7	7	7	7B	14	21	21	14	14	14

WESTERN UNITED STATES TO:

ALASKA	21	21	14	7	7	7	7	7	14	21	21	21
ARGENTINA	28	21	14	14	14	7	7	21A	21A	28	28	28
AUSTRALIA	28	28	21	14	14	14	14	7B	14	14	21	28
CANAL ZONE	21	14	14	14	7	7	7	21	28	28	28	28
ENGLAND	7A	7B	7	7	7	7B	7B	14	21	21	14	14
HAWAII	28	28	21A	14	14	14	14	7	14	21A	28	28
INDIA	14	21	14	7B	7B	7B	7B	7B	14	14	14	7B
JAPAN	21A	21	14	14	7B	7	7	7	7	7B	14	21A
MEXICO	21	14	7	7	7	7	7	14	21	21	21	21A
PHILIPPINES	21A	21A	21	14	7B	7B	7	7	14	14	7B	14A
PUERTO RICO	21	14	14	14	14	7	7	14A	21A	28	28	28
SOUTH AFRICA	21	14	14	7B	7B	7B	14	21	21	21A	21A	21
U. S. S. R.	7B	7B	7	7	7	7B	7B	14	14	14	14	14
EAST COAST	21	14	14	7	7	7	7A	14A	21	21A	21A	28

A. Next higher frequency may be useful this hour.

B. Very difficult circuit this hour.

Good: 1, 4-9, 12-14, 19-22, 25, 26, 29-31

Fair: 10, 11, 15, 23, 24, 27, 28

Poor: 2, 3, 16-18

VHF: 1, 6-8, 14, 15, 18

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The Stelma Telegraph Distortion Analyzer type TDA-2 is a self contained portable unit designed to measure bias and distortion of telegraph start-stop signals. Distortion is indicated by vertical pips displayed in a rectangular pattern on the face of a cathode ray tube. Measurements can be made while the machine is operating. Measurements can be made on circuits operating at 60, 75 or 100 OPM on 20 or 60 ma. neutral circuits or 30 ma. polar circuits. Distortion measurements from 0 to 50 percent with an accuracy of plus or minus two percent can be made. The set is patched in series with the loop and direct measurements made. No special skills required to make measurements after a few minutes practice. See your distortion, then adjust and watch it disappear.
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PART	NUMBER	PRICE EACH
Bearing (5 pack)	10717	$.25
Bracket	52529	.15
Bracket	53168	.10
Bracket	55147	.25
Bracket	56205	.10
Clamp	29532	.10
Hub Assembly	55155	.50
Key (Y)	54038	.25
Key (Repeat)	54043	.25
Key (D)	54046	.25
Key (K)	54051	.25
Key (Car. Ret.)	54053	.25
Key (X)	54056	.25
Key (C)	54057	.25
Key (V)	54058	.25
Latch	52963	.05
Lever	52434	.50
Lever	52477	.25
Lever	52534	.25
Lever	56265	.25
Lever	59477	.15
Lever, Stop	55740	.15
Link	55506	.20
Plate, Terminal	50981	.25
Plate, Sprocket (10 pack)	55160	.50
Ribbon Feed	50400	1.00
Wheel, Ratchet	52807	.25

TELETYPE CORP. PARTS

PART	NUMBER	PRICE EACH
Gear	97576	$.20
Gear	156555	.20
Lever, Contact	125849	.50
Lever, Function (Number 9)	74130	.50
Lever, Function (Number 2)	74131	.50
Lever, Shift	74235	.15
Modification Kit (Mechanical Motor Stop)	87403	1.00
Mounting Assembly, Relay	74814	.15
Pinion	117304	.20
Plate, Insulating (50 pack)	82546	.50
Panel, Glass	7362	.50
Post	99294	.10
Post, Threaded (5 pack)	97639	.50
Ribbon Feed Assembly	74353	1.00
Roller, Lock Loop (5 pack)	82511	.50
Roller, Operating Bail	74157	.10
Sleeve, Bearing	97568	.50
Spring (10 pack)	152839	.50
Spring, Drag	74878	.25
Stiffener (5 pack)	4043	.50
Stripper, Pull Bar	74933	.50
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Tape Guide	82281	.10
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Track, Upper	74200	.50
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Typebar	98976	.20
Typebar	99001	.20
Typebar	99028	.20
Typebar	99032	.20
Typebar	99034	.20
Typepallet (5 pack)	82152	.50
Typepallet (5 pack)	82153	.50
Typepallet (5 pack)	98915	.50
Typepallet (5 pack)	98928	.50
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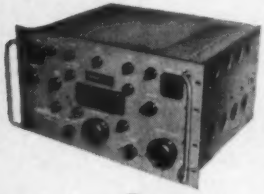

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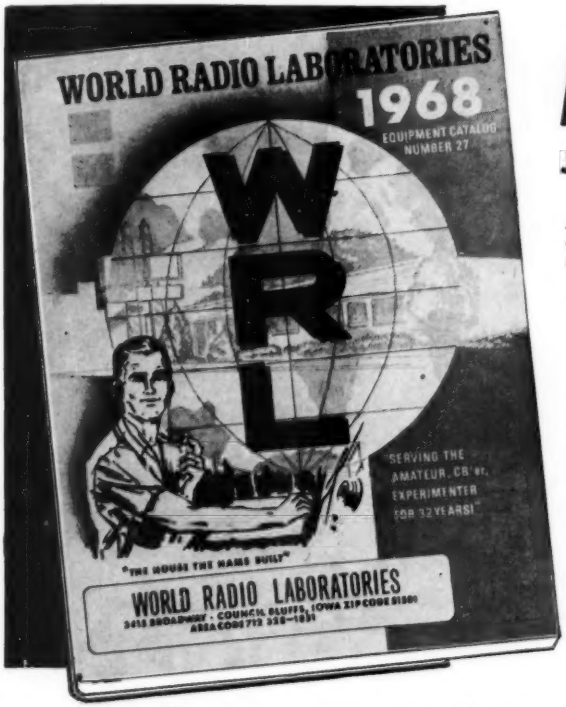

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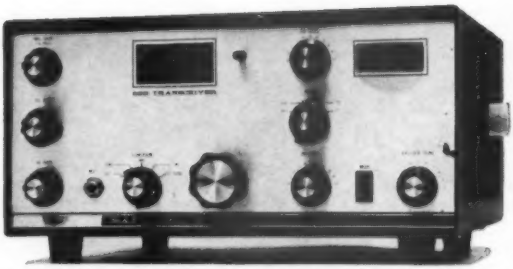

For only $359, the new National 200 puts you on the air, with complete SSB, CW, and AM coverage of the 80 through 10 meter bands. You'll get years of enjoyment from this husky rig, thanks to National's field-tested design and workmanship, and these terrific performance features: *200 Watt PEP input on SSB, grid-block keying on CW, and compatible AM operation *Separate product and AM detection plus fast-attack slow-release AGC in all modes *Crystal-controlled pre-mixing with single VFO for high stability, plus identical calibration rate on all bands *Crystal lattice filter for high sideband suppression on transmit, and rejection of adjacent-channel QRM on receive . . . plus solid-state balanced modulator for "set-and-forget" carrier suppression *Universal mobile mount included.

Boost your power to a full 2000 watts... only 38¢ per watt!

Only 38¢ per Watt adds 1800 Watts PEP input to your National 200 . . . lets you push out the maximum power allowed by law. The NCL-2000 is a completely self-contained 2000-Watt SSB PEP linear amplifier for the 80 through 10 meter bands, with minimum peak output of 1300 Watts. *Amplifier Bias Control Circuit (Pat. #3,328,715) reduces distortion. Operate CW? AM? RTTY? The National NCL-2000 is rated for full kW operation in these services. You *know* you'll be heard when you add on this desk-top package of dynamite! The price? . . . $685, when you're ready for the big time.

Both the National 200 and the NCL-2000 are covered by National's exclusive One Year Guarantee against component failure.

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